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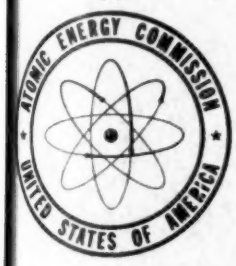

Technical Information Extension, Oak Ridge, Tennessee

NUCLEAR SCIENCE ABSTRACTS

Volume 10 February 15, 1956 No. 3

GENERAL

ATOMIC POWER

1150 ATC-54-12
American Turbine Corp., New York.
DESIGN STUDY—60 MW CLOSED CYCLE GAS TURBINE NUCLEAR POWER PLANT. Dec. 1954. 40p.

The power generating equipment is described for a closed gas turbine for use in a nuclear power plant. Data are summarized on the power plant cycle and plant operating conditions. Data are based on the assumption that a graphite moderated enriched fuel reactor designed for conversion or breeding is employed. (C.H.)

1151 NPG-126
Nuclear Power Group, Chicago.
ENVIRONMENTAL FACTORS AT PROPOSED SITE OF DRESDEN GENERATING STATION OF COMMONWEALTH EDISON COMPANY. W. M. Kiefer, M. N. Chiarottino, D. W. Geue, and A. F. Veras. June 15, 1955. 69p.

This report contains an appendix of Climatological Data for Chicago, Joliet, and Peoria, Illinois, by the Weather Bureau.

In compliance with AEC licensing regulations, the population distribution, geology, seismology, hydrology, and meteorology for the proposed Commonwealth Edison Company's atomic power plant location have been determined. Results of this analysis are presented. (D.E.B.)

1152 AERE-Lib/Trans-601
ATOMIC ENERGY—A JUMP TOWARDS A RICHER LIFE. Translated by J. Rundo from Politikens Ugeblad for Danske i Udlandet, No. 26, June 26, 1955 to July 7, 1955. 5p.

A general discussion is given of the advances of atomic energy, in particular, those in Denmark. (B.J.H.)

Refer also to abstract 1551.

BIOLOGY AND MEDICINE

1153 UCLA-355
California. Univ., Los Angeles. Atomic Energy Project.
STUDIES OF THE NEW HAMPSHIRE CHICKEN EMBRYO. VI. NITROGEN AND LIPIDE COMPONENTS OF CHYLOMICRONS, TOTAL BETA LIPOPROTEINS, $BETA_1$ AND $BETA_2$ LIPOPROTEINS. Ole Arne Schjeide and Nancy Ragan. Nov. 21, 1955. 18p. Contract AT-04-1-GEN-12.

1154 UCRL-3141
California. Univ., Berkeley. Radiation Lab.
THE EFFECT OF CERTAIN LIPID MATERIAL ON THE ULTRACENTRIFUGAL PROPERTIES OF SERUM AND EGG LIPOPROTEINS. Thomas L. Hayes and John E. Hewitt. Sept. 19, 1955. 10p. Contract W-7405-eng-48.

Serum and egg lipoproteins interact in vitro with fatty acid and neutral fat emulsion. The resulting lipoprotein in general has a greater flotation rate, suggesting an incorporation of low-density material into the lipoprotein molecules. (auth)

1155 AEC-tr-2327
THE SIGNIFICANCE OF TRACE ELEMENTS IN PLANT, ANIMAL AND HUMAN NUTRITION. A. Jacob. Translated from Naturw. Rundschau 8, 309-14(1955). 27p.

1156 AERE-Lib/Trans-1484
CONTRIBUTION TO THE KNOWLEDGE OF ELASTIC FIBRES AND SINEWS. (Special Report). G. Petry. Translated by F. Hudswell from p.183-5 in "Verhandl. Anat. Ges." at the 49th Meeting at Heidelberg, 16th to 19th April 1951. 2p.

1157
STUDIES ON THE tu^W STRAIN OF DROSOPHILA MELANOGASTER. I. PHENOTYPIC AND GENOTYPIC CHARACTERIZATION. Louise P. Wilson, R. C. King, and Joan L. Lowry (Wellesley Coll., Mass. and Brookhaven National Lab., Upton, N. Y.). Growth 19, 215-44(1955).

1158
THE NEUROCHEMICAL SIGNIFICANCE OF EXPERIMENTALLY INDUCED MALFORMATIONS IN MAMMALS. Samuel P. Hicks, Charlotte E. De Harport, Laura A. Johnson, and Barbara L. Brown (New England Deaconess Hospital and Harvard Medical School, Boston). p.491-8 in "Biochemistry of the Developing Nervous System." New York, Academic Press Inc., 1955.

AEROSOLS

1159
OPERATING ECONOMICS OF AIR-CLEANING EQUIPMENT UTILIZING THE REVERSE JET PRINCIPLE. William B. Harris (U. S. Atomic Energy Commission, New York) and Mont G. Mason (Mallinckrodt Chemical Works, St. Louis). Ind. Eng. Chem. 47, 2423-5(1955) Dec.

Operating data are presented on the dust collectors in use at the Mallinckrodt Chemical Works. (C.W.H.)

RADIATION EFFECTS

1160 AECU-3109
Utah. Univ., Salt Lake City. Radiobiology Lab.
SEMI-ANNUAL PROGRESS REPORT TO THE DIVISION OF BIOLOGY AND MEDICINE. Sept. 30, 1955. 80p. Contract AT(11-1)-119.

Approval of detailed plans and specifications covering the approved additions to the existing facilities is expected momentarily. Progress is reported in the following studies: the tissue distribution, hematological effects, and toxicity of Pu, Ra^{226}, mesathorium (Ra^{228}), radiothorium (Th^{228}), and Sr in dogs; radioautographic analysis of bone following administration of Ra^{228} and Th^{228}; the incidence of spontaneous tumors in dogs injected with Ra^{226}; the

effect of parathyroid extracts on the uptake of Pu in rats; radioautographic and histopathological studies on dogs following the intravenous administration of Sr^{90}; determinations of plasma Fe values for beagle dogs; and tracer studies, using Cr^{51} tagged red blood cells, of the anemia produced in dogs following the administration of Ru, Ra, MsTh, and MdTh in beagle dogs. (C.H.)

1161 ANL-5486

Argonne National Lab., Lemont, Ill.

QUARTERLY REPORT OF BIOLOGICAL AND MEDICAL RESEARCH DIVISION. Oct. 1955. 103p. Contract W-31-109-eng-38.

A survey on geographic incidence of skin tumors indicates higher skin tumor rates in white populations closer to the equator. Data are reported from studies on the identification and control of mites found on laboratory mice; cell division time in yeast; design of micropipettes; design of an experimental liquid chamber for use in phase microscopy; the tissue distribution of Sr^{90} in cats; factors affecting the stability of liquid scintillation systems; the biosynthesis of methionine in bacteria; the demonstration of Golgi apparatus in cells from cricket testes; morphology of frog oocytes; the intracellular distribution of enzymes; the pathological effects of γ and x radiation on mice; the application of kinematic equations in studies of the behavior of biological systems; the effect of photoperiod on indoleacetic acid oxidase in lupine; the construction and applications of a chamber for the simulation of high altitudes; the protective effects of spleen homogenates and aminopterin against radiation injuries in mice; the radiation syndrome in chickens; lead poisoning in rats; tracer studies on thyroid distribution and function in goldfish; the relationship of boron nutrition to radiosensitivity in sunflower plants; determination of body burden of Th^{227} following a puncture wound made with contaminated forceps; and an analysis of kinetic data on a γ-ray cloud. (For preceding period see ANL-5456.) (C.H.)

1162 COO-210

Michigan. Univ., Ann Arbor. Engineering Research Inst.

HIGH RADIOPASTEURIZATION AS A "NEW" FOOD PROCESS. L. E. Brownell and S. N. Purohit. Oct. 1955. 42p. Contract AT(11-1)-162. (ERI-1943-7-51-P)

A process called radiopasteurization, in which high γ radiation is combined with refrigeration, is proposed to increase the storage life of cooked meats, blanched vegetables, and food items packaged in plastic bags. Various types of food poisoning caused by microörganisms and their toxins are reviewed, and their control by radiopasteurization is discussed. Design features of a high-radiopasteurization γ facility, utilizing mixed fission products or packaged Cs^{137} as the source, are described. The proposed plant would be capable of processing about two tons per hour with two eight-hour shifts per day for 260 days per year, and could irradiate foods with a high-radiopasteurization dose of one megarep at an estimated cost of about one cent per pound. This cost is considered to be in the range of commercial feasibility. (C.H.)

1163 HW-38758

Hanford Atomic Products Operation, Richland, Wash.

HISTOPATHOLOGY OF SHEEP THYROID IN CHRONIC ADMINISTRATION OF I^{131}. S. Marks, N. L. Dockum, and L. K. Bustad. Aug. 23, 1955. 44p. Contract W-31-109-Eng-52.

The pathologic effects in the thyroid glands of sheep receiving chronic oral administration of I^{131} are reported. Dose levels employed ranged from 0.15 μc to 1800 μc per day. No pathologic alterations were observed with a daily feeding level of 0.15 μc after a maximum period of observation of four years. The principal early manifestations of thyroid damage were interfollicular fibrosis in adults receiving 5 μc daily and interfollicular edema in their offspring. Focal inflammation was the initial effect resulting from a daily dose of 480 μc. At feeding levels between 5 and 480 μc per day, various combinations of edema, inflammation and fibrosis occurred. Prolonged administration of higher levels of I^{131} caused necrosis of follicles or infarcts. Progressive arterial damage was observed, including intimal thickening, changes in the internal elastic membrane, destruction of the smooth muscle of the media, and eventual obliteration of the lumens. The pathologic changes observed involve the interstitial tissue, epithelium, and blood vessels. The effects on the interstitial tissue may be considered of primary significance in the early diagnosis of low-level chronic exposure to I^{131} in the species investigated. (auth)

1164 NM-006-012.04.74

Naval Medical Research Inst., Bethesda, Md.

LONG-TERM OBSERVATIONS OF RADIATION CHANGES IN SALIVARY GLANDS AND THE GENERAL EFFECTS OF 1,000 r to 1,750 r OF X-RAY RADIATION LOCALLY ADMINISTERED TO THE HEADS OF DOGS. James A. English, Merrill G. Wheatcroft, H. W. Lyon, and Clarence Miller. Sept. 21, 1955. 13p.

Considerable morphologic alteration was observed in the salivary glands of dogs which had received 1,750 r of 200 kvp x ray radiation locally to the head. From a total of 6 dogs which were irradiated, 5 were sacrificed during a 5 to 16 months' period following exposure and provided the experimental material for histologic study. Normal glands were obtained from 7 unirradiated dogs for comparison. Several special fixatives and stains were used in order to adequately observe the nuclei, mitochondria, connective tissue, and various cellular products of the salivary glands. The parotid, submaxillary, and sublingual glands of 3 dogs which received 1,750 r, and were sacrificed 25, 29, and 34 weeks later, were atrophied, fibrosed, and altered in morphologic detail. Except for knowledge of the anatomic areas from which the tissues were taken, or by special staining reactions, it would have been impossible to identify many tissue sections. The severe changes consisted in various grades of obliteration of acini, leaving whorls of nuclei in streaked concentric patterns, fragmented cells, groups of cells without pattern, partly damaged acini in which one or two cells were identifiable and the rest were vacuolated or in signet-ring configuration. A dog receiving the same amount of treatment, which was sacrificed 58 weeks afterwards, had much less apparent total damage, but in many areas some of the changes described above could be found. A dog receiving 1,000 r and sacrificed 68 weeks afterwards had relatively normal-appearing salivary glands. The general changes observed were stomatitis, surface sloughing and oral hemorrhage in mild to moderate degree, erythema of exposed areas, particularly over the ears, and around the eyes, and epilation. Hair grew back in after 6 to 12 weeks and was light grey in color. Dogs appeared to be moderately distressed after treatment and one animal developed an ulcerating lesion of the neck. (auth)

1165 NM-006.012.05.12

Naval Medical Research Inst., Bethesda, Md.

NEOPLASMS IN RATS PROTECTED AGAINST LETHAL DOSES OF IRRADIATION BY PARABIOSIS OR PARA-AMINOPROPIOPHENONE. George Brecher, E. P. Cronkite, and James H. Peers. Oct. 20, 1953. 19p.

Rats that survived otherwise lethal doses of radiation when protected by para-aminopropiophenone or parabiosis are followed along with their normal controls for the rest of their natural lives. Seventy animals have been irradiated. Of these, 22 have survived 6 months or more. In these survivors there has appeared between 6 and 16 mo after irradiation an adamantinoma, renal carcinoma, sarcoma, glioma, adenocarcinomas of the duodenum, jejuneum, ileum, and colon, and a uterine sarcoma. During this time no tumors have developed in control animals. The high incidence of tumors in this small group of animals, and the incidence of tumor types that seldom occur spontaneously, indicate that these neoplasms were induced by whole-body irradiation. (auth)

1166 NP-5822

School of Aviation Medicine, Randolph AFB, Tex.

THE SOLUTION OF DISCRIMINATION-REVERSAL PROBLEMS BY NORMAL AND IRRADIATED MONKEYS. Report No. 16. J. M. Warren, S. J. Kaplan, and D. D. Greenwood. Apr. 1955. 5p. Project No. 21-3501-0003.

Three normal monkeys and seven monkeys which had received sublethal doses of neutron and gamma radiation were tested on a series of 108 discrimination-reversal problems. The following results were obtained: there was no significant difference between groups in prereversal learning; the radiated subjects made significantly more errors than normal controls on the post-reversal trials; the error scores of individual irradiated monkeys were not correlated with differences in individual dose levels. (auth)

1167 NYO-4924

Western Reserve Univ., Cleveland. School of Medicine.

FURTHER STUDIES ON THE RELATIONSHIP BETWEEN OXYGEN TENSION AND THE PROTECTIVE ACTIONS OF CYSTEINE, MERCAPTOETHYLAMINE AND PARA AMINOPROPIOPHENONE. Paul R. Salerno, Edwin Uyeki, and Hymer L. Friedell. Dec. 1, 1955. 27p. Contract W31-109-eng-78.

The relationship between modification of the lethal action of x rays and effects of chemical agents on tissue oxygen tension was investigated. Femoral venous blood from rats treated with cysteine showed a 50% reduction in O content without significant alteration in CO_2 production. Tissue slices of spleen and liver removed from rats treated with cysteine exhibit increases of 40 to 50% in O uptake. Spectrophotometric determination of tissue sulfhydryl content revealed that cysteine is rather evenly distributed in all tissues with the exception of a markedly lower concentration in the brain. In comparison with cysteine, mercaptoethylamine on an equimolar basis is oxidized at a much faster rate, is more potent, but has a shorter duration of protective action against x rays. Para-aminopropiophenone and pentobarbital potentiate the protective actions of cysteine and mercaptoethylamine. The magnitude of the greatest x-ray dose reduction effected by combinations of chemical protective agents is approximately 50%, which is comparable to that produced by severe hypoxia in rats. O under a pressure of 60 lbs/in^2 during exposure to x rays abolished the protective actions of cysteine, PAPP, and mercaptoethylamine in rats. (auth)

1168 ORNL-1953

Oak Ridge National Lab., Tenn.

BIOLOGY DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING AUGUST 15, 1955. E. J. Slaughter, ed. Dec. 12, 1955. 141p. Contract W-7405-eng-26.

Progress is reported on the following studies: the cytogenetic effects of radiation in Paramecium, Tetrahymena, Tradescantia, Vicia, Neurospora, maize, timothy roots, wasps, Nemeritis, Habrobracon, and Drosophila; radiation protection and recovery in bacteria; modification of radiation injuries in mice; effects of radiation on genetic factors and development in mice; pathological and physiological effects of radiation in rats; tracer studies in intermediate metabolism in microörganisms; studies on nucleic acids, enzymes, and radiation protective compounds in microörganisms; enzymology and photosynthesis; plant biochemistry; the design of a centrifuge head for gradient differential centrifugation; the preparation of tissue homogenates; serological data on tumor cells; the biophysical effects of radiation on Tradescantia; and dose rates from a fast neutron facility. (For preceding period see ORNL-1863.) (C.H.)

1169 ORO-145

Tennessee. Univ., Knoxville.

AGRICULTURAL RESEARCH PROGRAM. Semi-annual Progress Report for January 1, 1955 to June 30, 1955. Nov. 1955. 134p. Contract AT-40-1-GEN-242.

Data are presented from the following studies: fission product metabolism in domestic animals; factors affecting Ca metabolism in domestic animals; the effects of whole-body irradiation on the sperm of bulls; the physiology of milk secretion using I^{131} as a tracer; and the response of burros, swine, and sheep to various doses of total-body γ radiation. (C.H.)

1170 TID-8001

Technical Information Service, AEC.

PROPOSED NEW METHOD OF WHOLESALING FRESH MEAT BASED ON PASTEURIZATION BY GAMMA IRRADIATION. L. E. Brownell, J. V. Nehemias, and J. J. Bulmer. Nov. 1955. 7p.

One of Its monograph series "The Industrial Atom."

A general discussion is given on the wholesaling of fresh meat based on pasteurization by γ irradiation. Included are discussions of recent trends in retailing meat, γ-ray pasteurization of fresh meat and seafoods as a public health measure, results of microbiological studies on meats, taste studies on γ-pasteurized meat, and the proposed method of pasteurization. Advantages of the system are listed. (B.J.H.)

1171

EFFECTS OF RADIOACTIVE COBALT (Co^{60}) γ RADIATION ON CARBOHYDRATES. M. A. Khenokh (Lesgraft State Inst. of Natural Science) Doklady Akad. Nauk S.S.S.R. 104, 746-9(1955) Oct. 11. (In Russian).

Effects of γ radiation on 0.25% solution of starch and insulin, and 0.14 M solutions of glucose, fructose, maltose, lactose, saccharose and raffinose (0.08 M) were studied. Diagrams of the ultraviolet light absorption by the above solutions are given. (R.V.J.)

1172

EFFECTS OF IONIZING RADIATION ON CATALASE. P.

Bonet-Maury and F. Patti. J. chim. phys. 52, 617-20(1955) Sept. (In French)

Catalase, purified by electrophoresis, is inactivated by x rays with much greater difficulty than the Armour and Pabst catalases, which have very close inactivation curves and ultraviolet spectra. Elimination of the dissolved oxygen does not modify the radiosensitivity of the various catalases, which all show important post-effects. The experimental results can be interpreted by attributing the major role in the radioinactivation of catalase to the OH radicals or to their oxygenated derivatives. The interaction of the H radicals does not seem to be very important. (tr-auth)

1173

BIOLOGIC EFFECTS STUDIES ON MICROWAVE RADIATION. TIME AND POWER THRESHOLDS FOR PRODUCTION OF LENS OPACITIES BY 12.3 Cm. MICROWAVES. D. B. Williams, J. P. Monahan, W. J. Nicholson, and J. J. Aldrich. Arch. Ophthalmol. 54, 863-74(1955). Dec.

In order to establish the time and power requirements for experimental lens opacity production by single doses of 12.3-cm microwave radiation, 58 anesthetized rabbits were exposed to the radiation. Opacities occurred in 32 rabbits and are described in detail. It is suggested that the radiation might also be dangerous to humans. (B.J.H.)

1174

ADRENAL ASCORBIC ACID AND HISTOLOGICAL CHANGES IN MALE AND FEMALE RATS AFTER HALF-BODY X-RAY IRRADIATION. Bernard C. Wexler, Richard Pencharz, and Sydney F. Thomas (Stanford Research Inst., Stanford Univ. School of Medicine, and Palo Alto Clinic, Calif.). Am. J. Physiol. 183, 71-4(1955) Oct.

1175

EFFECTS OF IONIZING RADIATIONS ON CARBOHYDRATE EXCHANGE IN ANIMAL ORGANS. B. M. Graevskaya and R. Ja. Keĭlina. Uspekhi Sovremennoĭ Biol. 40, 230-8(1955) Sept.-Oct. (In Russian)

Review. 63 references. (R.V.J.)

1176

ACTION OF IONIZING RADIATION ON CATALASE IN THE PRESENCE OF CYSTEINE, CYSTINE, AND GLUTATHION. W. M. Dale and C. Russell (Christie Hospital and Holt Radium Inst., Manchester, England). J. chim. phys. 52, 621-5(1955) Sept. (In French)

High energy electrons, Co^{60} γ rays, and x rays were used to study the effect of radiations on catalase. Results of experiments are discussed in detail. (B.J.H.)

1177

SUBSEQUENT REGENERATION OF NEREIS DIVERSICOLOR O. F. MULLER AFTER LOCAL IRRADIATION WITH X RAYS. Francoise Stephan-Dubois. Comp. rend. 241, 1175-7(1955) Oct. 24. (In French)

Each worm was isolated in a Petri dish. The grubs were amputated between $\frac{1}{2}$ and $\frac{3}{4}$ of the way from the end of the body and were then irradiated with x rays. Totally irradiated worms did not regenerate, and regeneration of locally irradiated worms was delayed. (B.J.H.)

1178

COMPARATIVE STUDY OF THE SECONDARY SPLENIC LESIONS FROM A SELECTIVE IRRADIATION OF THE SPLEEN OR FROM AN IN TOTO IRRADIATION OF THE RAT BY X RAYS. Michel Boiron, Claude Paoletti and Maurice Tubiana. Compt. rend. 241, 1231-4(1955) Oct. 31. (In French)

After irradiation of the spleen, the importance of splenic lesions, determined by the decrease of the weight of the organ and the histological appearance, is, for an equal local dose (1000 r), greatly attenuated when the rest of the body is protected from radiation. (tr-auth)

1179

EFFECTS OF ACUTE X-IRRADIATION ON THE EVOKED CEREBELLAR RESPONSE. John C. Lee, Skuli Helgason, and Ray S. Snider (Northwestern Univ., Chicago). Radiation Research 3, 267-71(1955) Nov.

The evoked neurological response of the cerebellum was recorded in cats while the animals were being irradiated with 220-kv x rays at rates of 50 to 120 r/min. Amplitude of the evoked cerebellar response began to decrease at an average value of 6000 r but varied within a range of 1500 r on either side of this value. Animals to which more than 10,000 r was administered showed severe flattening of the response. Both the primary response and the after-discharge were affected by irradiation. Responses, reduced during exposure to radiation, showed a further reduction in the early post-irradiation period. (auth)

1180

RADIATION AS A CARCINOGENIC AGENT. Austin M. Brues (Argonne National Lab., Lemont, Ill.). Radiation Research 3, 272-80(1955) Nov.

An examination of current knowledge concerning the mechanism of radiation carcinogenesis has been made from the standpoint of its possible bearing on human carcinogenesis at low levels of radiation. In a few cases, notably lymphomas and ovarian tumors in mice, it is obvious that the response is indirect and works through a physiological mechanism involving more than the irradiated cell. These instances show the greatest variation between species. Although local irradiation yields tumors in the directly irradiated area, an indirect mechanism is also apparent, in that there is a considerable latent period during which successive tissue changes take place leading eventually to autonomous tumor growth. The latent period is probably related to the life span of a given species. Present evidence indicates that intense local irradiation is somewhat wasteful of the energy involved, with respect to cancer production. This has not been satisfactorily tested at low dosage levels. A single irradiation can be effective, but good evidence as to the effect of dividing doses is lacking. The influence of ion density and dose-response relationships, although partly understood, require further investigation. Some difficulties with the somatic mutation theory have been discussed. Although a cellular mutation may be one necessary step in tumor formation after irradiation, the present evidence suggests that it must play a subordinate role. (auth)

1181

TESTS FOR A ROLE OF H_2O_2 IN X-RAY MUTAGENESIS. I. ESTIMATIONS OF THE CONCENTRATION OF H_2O_2 INSIDE THE NUCLEUS. John Z. Hearon and R. F. Kimball (Oak Ridge National Lab., Tenn.). Radiation Research 3, 283-94(1955) Nov.

Equations are derived which permit the estimation of the concentration of H_2O_2 in the micronuclei of Paramecium aurelia when known concentrations of H_2O_2 are added to the medium and when the cells are irradiated. Since exact solutions of the diffusion-reaction equations which apply to these

situations are not possible with known mathematical techniques, approximate solutions are presented. On the basis of observed cell dimensions and measured consumption rates for H_2O_2 by intact cells, the use of the approximate equations is validated. The determination of the necessary parameters from experimental data is discussed. In particular it is shown that the ratio of the micronuclear concentration to the concentration in the medium is essentially the same when the cells are placed in an H_2O_2-containing medium and when they are exposed to irradiation. Therefore, rather precise comparisons of the two situations can be obtained. (auth)

1182

THE EFFECTS OF γ-IRRADIATION AND OF AMINOPTERIN ON THE METABOLISM OF FORMATE-C^{14}, GLYCINE-2-C^{14}, AND ADENINE-8-C^{14} BY CHICK EMBRYOS. J. V. Passonneau and J. R. Totter (Oak Ridge National Lab., Tenn.). Radiation Research 3, 304-14(1955) Nov.

1183

UPTAKE OF RADIOSULPHATE IN DIFFERENT ORGANS AFTER TOTAL BODY IRRADIATION. Erik Odeblad and Donato Ziliotto. Acta Radiol. 44, 313-16(1955) Oct.

Total-body roentgen irradiation in the lethal dose range of rats and mice did not appreciably change the uptake of radiosulphate, within two days after irradiation, by the intestine, trachea, skin, ovary, and kidney, as revealed autoradiographically. (auth)

1184

ACTION OF A SINGLE X-RAY DOSE, ADMINISTERED IN TOTAL OR LOCAL IRRADIATION, ON THE NUCLEIC ACIDS OF THE BONE MARROW IN THE WHITE RAT. J. Rodesch, C. Jaudel, B. Chirpaz, and P. Mandel. Experientia 11, 437-8(1955) Nov. 15. (In French)

1185

STUDIES ON SUSCEPTIBILITY TO INFECTION FOLLOWING IONIZING RADIATION. III. SUSCEPTIBILITY OF THE INTESTINAL TRACT TO ORAL INOCULATION WITH PSEUDOMONAS AERUGINOSA. Carolyn W. Hammond, David Ruml, Dorothy B. Cooper, and C. Phillip Miller (Univ. of Chicago). J. Exptl, Med. 102, 403-11(1955) Oct. 1.

1186

STUDIES ON SUSCEPTIBILITY TO INFECTION FOLLOWING IONIZING RADIATION. IV. THE PATHOGENESIS OF THE ENDOGENOUS BACTEREMIAS IN MICE. Lee E. Gordon, David Ruml, Helen Jo Hahne, and C. Phillip Miller (Univ. of Chicago). J. Exptl. Med. 102, 413-24(1955) Oct. 1.

1187

ANTIBIOTIC INDUCED BACTERIAL CHALLENGE OF IRRADIATED MICE. William T. Bradner and Ann M. Hald (Brown Univ., Providence, R. I.). Antibiotics and Chemotherapy 5, 499-504(1955) Sept.

RADIATION HAZARDS AND PROTECTION

1188 AECD-3714

National Lead Co. of Ohio, Cincinnati.

INDUSTRIAL HYGIENE SURVEY OF THORIUM ROLLING AT SIMONDS SAW AND STEEL COMPANY. Charles E. Schumann. Dec. 14, 1953. Decl. with deletions Dec. 9, 1955. 18p. Contract AT(30-1)-1156.

Personnel exposures to the radioactive dust from a thorium rolling operation are tabulated. (B.J.H.)

1189 USNRDL-TR-64

Naval Radiological Defense Lab., San Francisco.

EFFICACY OF HEMATOPOIETIC PROTECTIVE PROCEDURES IN RATS X-IRRADIATED WITH INTESTINE SHIELDED. M. N. Swift, S. T. Taketa, and V. P. Bond. Sept. 13, 1955. 14p. Project NM-006-015.

Bone marrow dosage of the order of 60 to 90 mg/100 g body weight was required for optimal protection against mortality in rats x-irradiated with the exteriorized gastrointestinal tract shielded. Although the degree of protection obtained by shielding the spleen or one hind leg during x irradiation (with gastrointestinal tract shielded) was roughly comparable to that obtained through post-exposure marrow injection, survival was significantly reduced if the previously shielded spleen was subsequently extirpated, or the leg subsequently irradiated, after intervals up to 3 days following the initial exposure. On comparing these findings with the results of previous studies of a similar nature in whole body x-irradiated mice, it appears that the protective potential of spleen or marrow per se is considerably lower in the rat than in the mouse, and that the exceptional radiosensitivity of the rat intestine cannot account entirely for the lesser efficacy of hematopoietic therapy against whole-body radiation mortality in this species. (auth)

1190

RADIOSENSITIVITY OF ANOXIC SKIN IN RELATION TO TEMPERATURE. J. P. O'Brien, E. J. Frank, and J. L. Garner (Marquette Univ., Milwaukee). Science 122, 1140 (1955) Dec. 9.

Results are summarized from studies on the effect of temperature during irradiation on the radiosensitivity of skin when variations in oxygen tension are simultaneously precluded. It was concluded that the temperature prevailing in anoxic mammalian tissue at the time of irradiation is a significant factor in modifying dose effects. (C.H.)

1191

X-IRRADIATION IN HAMSTERS, AND EFFECTS OF STREPTOMYCIN AND MARROW-SPLEEN HOMOGENATE TREATMENT. Willie W. Smith, Robert Q. Marston, Leon Gonshery, Ilo M. Alderman, and H. Jeanette Ruth (National Insts. of Health, Bethesda, Md.). Am. J. Physiol. 183, 98-110(1955) Oct.

1192

REDUCTION IN X-RAY SENSITIVITY OF SEEDS BY HYDRATION. Richard S. Caldecott (Univ. of Minnesota and Brookhaven National Lab., Upton, N. Y.). Nature 176, 306(1955) Aug. 13.

1193

THE INFLUENCE OF PLOIDY AND DIVISION STAGE ON THE ANOXIC PROTECTION OF SACCHAROMYCES CEREVISIAE AGAINST X-RAY INACTIVATION. C. A. Beam (Univ. of California, Berkeley). Proc. Natl. Acad. Sci. U. S. 41, 857-61(1955) Nov.

1194

RADIOSENSITIVITY OF BACILLUS SUBTILIS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS. Bernard E. Proctor, Samuel A. Goldblith, E. Marilyn Oberle, and William C. Miller, Jr. (Massachusetts Inst. of Tech., Cambridge). Radiation Research 3, 295-303(1955) Nov.

1195

EFFECTS OF HYDRATION ON X-RAY SENSITIVITY IN

HORDEUM. Richard S. Caldecott (Brookhaven National Lab., Upton, N. Y.). Radiation Research 3, 316-30(1955) Nov.

Prior to x-radiation the water content of seeds of barley has been modified by storage at different relative humidities, steeping for 16 hours at 0°C followed by various periods of desiccation, and steeping at 0°C and 22°C for different periods of time. Pooling the data from all studies clearly shows that the sensitivity of barley seeds to x rays, as measured by inhibition of seedling growth and the frequency of chromosomal aberrations, decreases as the water content of the embryo increases from about 4% to about 8%. At this upper level a plateau is reached, and further addition of water to the embryo (up to 60%) results in no additional modification of sensitivity, providing that cellular activity is inhibited by low temperatures. The data suggest that previous ideas concerning the effect of hydration in substantiating the indirect action hypothesis of the action of radiation in cellular systems should be modified. (auth)

1196

THE PROTECTIVE EFFECT OF CYSTEAMINE AGAINST ROENTGEN RAY INJURY ON EARS OF RABBITS IRRADIATED UNDER CONDITIONS OF COMPLETE ANOXIA. Francis Lothe and Finn Devik. Acta Radiol. 44, 306-12 (1955) Oct.

In experiments with roentgen irradiation of rabbits' ears temporarily isolated from the rest of the animal, it was shown that conditions of complete anoxia and the presence of cysteamine during exposure had a protective effect against damage. Cysteamine seemed to give some slight additional protection when administered to ears irradiated in the anoxic state, indicating that cysteamine and anoxia to some degree act along different paths in the radiobiologic process. (auth)

1197

THE PROTECTIVE EFFECT OF VARIOUS CHEMICAL COMPOUNDS AGAINST DAMAGE TO CHROMOSOMES BY GAMMA RADIATION. Herbert Parkes Riley (Oak Ridge National Lab., Tenn. and Univ. of Kentucky, Lexington). Am. J. Botany 42, 765-9(1955) Nov.

Protection against x-ray damage to chromosomes, as measured by the frequency of chromosome interchanges and deletions produced in cells of onion root tips, is conferred by sodium hydrosulfite and BAL (2,3-dimercaptopropanol) in 2×10^{-3} and 2×10^{-4} M concentrations. Neither of these chemicals had any effect on the aberration frequency or the mitotic process which could be detected by cytological observation on unirradiated root tips. There is no consistently demonstrable effect of these chemicals on the mitotic process. Protection was found with these chemicals when the roots were placed in them for 30 min. before, during, and for ten min. afterward. Protection was just as great when the roots were in the solutions before and after but not during the irradiation. (auth)

Refer also to abstract 1199.

RADIOTHERAPY

1198

RADIOACTIVE GOLD FOR THE INTRACAVITARY TREATMENT OF CARCINOMA OF THE CERVIX. Michel Ter-Pogossian and Alfred I. Sherman (Washington Univ. School of Medicine, St. Louis, Mo.). Radiology 65, 779-84(1955) Nov.

In radiation therapy of carcinoma of the cervix the dose of radiation contributed by intracavitary radium is drastically limited by the tolerance of the rectum, bladder, and paracervical trangles. By surrounding the intravaginal radium with a suitable shield, it is possible to protect these radiosensitive structures, and to deliver a higher dose of radiation to the parametria. Unfortunately, the high energy of the radiation emitted by radium requires a thick shield, even of the heaviest metal, which fits only the roomiest vaginas. It is proposed to circumvent this difficulty by replacing the intravaginal radium by radioactive gold 198, which emits a lower energy gamma radiation than radium and consequently requires less shielding. An intravaginal gold 198 applicator casting a desirable pattern of radiation is described. (auth)

1199

ORGANIZING AND CONTROLLING THE USE AND SAFE HANDLING OF ISOTOPES. Bertram V. A. Low-Beer (Univ. of California School of Medicine, San Francisco). Hospitals 29, No. 12, 51-7, 156(1955) Dec.

Practices to insure the safe handling of radioisotopes for diagnostic and therapeutic uses are reviewed. (C.H.)

Refer also to abstract 1476.

TOXICOLOGY STUDIES

1200 LA-1309

Los Alamos Scientific Lab., N. Mex.

THE RELATIVE PHYSIOLOGICAL AND TOXICOLOGICAL PROPERTIES OF AMERICIUM AND PLUTONIUM. Wright Langham, Robert E. Carter, Elizabeth Busch, Ogden Johnson, Verda Strang, Theodore Trujillo, Marion Vier, Julia Wellnitz, and Agnes Williams. Nov. 15, 1951. Decl. Jan. 5, 1953. 57p. Contract W-7405-eng-36.

The relative physiological and toxicological properties of Am and Pu have been studied following their intravenous administration to rats. The urinary and fecal excretion of Am was similar to that of Pu administered as $Pu(NO_3)_4$. The deposition of Am in the tissues and organs of the rat was also similar to that observed for Pu. The liver and the skeleton were the major sites of deposition. Zirconium citrate administered 15 min after injection of Am increased the urinary excretion of Am and decreased the amount found in the liver and the skeleton at 4 and 16 days. LD_{30}^{50} studies showed Am was slightly less toxic when given in the acute toxic range than was Pu. The difference was, however, too slight to be important in establishing a larger tolerance dose for Am. Survival studies, hematological observations, bone marrow observations, comparison of tumor incidence and the incidence of skeletal abnormalities indicated that Am and Pu have essentially the same chronic toxicity when given on an equal μc basis. These studies support the conclusion that the tolerance values for Am should be essentially the same as those for Pu. (auth)

1201

INHALATION TOXICOLOGY OF CHLORINE TRIFLUORIDE. I. ACUTE AND SUBACUTE TOXICITY. Henry J. Horn and Robert J. Weir (Hazleton Labs., Falls Church, Va.). Arch. Ind. Health 12, 515-21(1955) Nov.

TRACER APPLICATIONS

1202 AECU-3117
Battelle Memorial Inst., Columbus, Ohio.
USE OF RADIOACTIVE INDICATORS IN THE STUDY OF THE MODE OF ACTION OF FUNGICIDES. Final Report. H. T. Kemp, R. W. Greenlee, M. M. Baldwin, R. S. Davidson, and W. C. Ellis, Jr. [1955?]. 47p. Contract [AT(11-1)-74].

1203 HW-36760
Hanford Atomic Products Operation, Richland, Wash.
SPOT DIAMETER METHOD OF QUANTITATIVE AUTORADIOGRAPHY OF Ru^{106} PARTICLES IN LUNG TISSUE. N. L. Dockum and J. W. Healy. Mar. 15, 1955. 8p. Contract W-31-109-Eng-52.

When Ru^{106} particles in lung are autoradiographed, a quantitative straight line function exists between the sum of the spot diameters or a single spot diameter and the total activity per slide. (auth)

1204
EFFECT OF HORMONES ON RENAL CLEARANCE OF RADIOIODINE IN THE RAT. Jaime Paris, Elizabeth Ford, Nona Lorenz, F. Raymond Keating, Jr., and A. Albert (Mayo Clinic, Rochester, Minn.). Am. J. Physiol. 183, 163-6(1955) Oct.

1205
URINARY EXCRETION, TUBULAR REABSORPTION AND BILIARY EXCRETION OF COBALT 60 IN DOGS. Cheng-Chun Lee and L. F. Wolterink (Michigan State Univ. and Michigan Agricultural Experiment Station, East Lansing). Am. J. Physiol. 183, 167-72(1955) Oct.

1206
BLOOD AND TISSUE PARTITION OF COBALT 60 IN DOGS. Cheng-Chun Lee and L. F. Wolterink (Michigan State Univ. and Michigan Agricultural Experiment Station, East Lansing). Am. J. Physiol. 183, 173-7(1955) Oct.

1207
THE PHOTOSYNTHETIC CYCLE. CO_2 DEPENDENT TRANSIENTS. A. T. Wilson and M. Calvin (Univ. of California, Berkeley). J. Am. Chem. Soc. 77, 5948-57 (1955) Nov. 20.

Techniques have been developed and an apparatus has been designed and constructed to make possible quantitative experiments in photosynthesis. It is now possible to measure the amounts of the photosynthetic intermediates as a function of external variables such as partial pressure of CO_2 and O_2, light, temperature, pH, poisons, and various combinations of these. Use has been made of the above techniques to study the transient changes taking place when the carbon dioxide pressure is varied and these results have led to the development of the concept of fluctuating reservoir sizes. These data also have provided the first unequivocal evidence of the relation of phosphoglyceric acid and ribulose diphosphate to the carbon dioxide acceptor and phosphoglyceric acid as being the product of the carboxylation. The data show that ribulose monophosphate and triose phosphate are also in the cycle which regenerates the carbon dioxide acceptor, and provide us with the precursor-product relationships between the compounds in this cycle. The kinetics of free glycolic acid provide strong evidence of the presence of a transketolase enzyme system which transfers an unphosphorylated glycolyl fragment. (auth)

WASTE DISPOSAL

Refer to abstracts 1327 and 1329.

CHEMISTRY

1208 AECU-3116
Michigan. Univ., Ann Arbor.
NUCLEAR CHEMICAL RESEARCH AND RADIOCHEMICAL SEPARATION PROGRESS REPORT NO. 4 [FOR] NOVEMBER 1954—OCTOBER 1955. Nov. 1, 1955. 87p. Project No. 7. Contract AT(11-1)-70.

The present facilities at the University of Michigan for research in nuclear chemistry are described. Modifications in the counting equipment are noted. The determination of (d,α) reaction cross sections is discussed. Procedures are presented for the chemical separation of product nuclei —Na, P, Sc, Mn, Ag, Ba, and Ir from the respective target materials. The alkaline-earth and Ag separations were investigated for optimum separation conditions. (C.W.H.)

1209 BMI-245
Battelle Memorial Inst., Columbus, Ohio.
THE SOLUBILITY OF SODIUM PHOSPHATE IN SODIUM HYDROXIDE SOLUTIONS. M. A. Youtz, F. A. Warren, and A. E. Bearse. Sept. 15, 1950. Decl. Nov. 30, 1955. 19p. Contract AT-30-1-Gen-228.

Data are presented on the solubility of trisodium phosphate in 10 to 50% sodium hydroxide solutions at temperatures ranging from 25 to 100°C. The results show that trisodium phosphate can be most satisfactorily removed from sodium hydroxide solutions at 40% sodium hydroxide concentration or higher, the temperature being practically immaterial, or it can be removed satisfactorily from 15 to 30% sodium hydroxide at 25°C. (J.E.D.)

1210 CCC-1024-TR-150
Callery Chemical Co., Penna.
KINETICS OF THE PYROLYSIS, HYDROLYSIS, AND OXIDATION OF BORANES AND ALKYL BORANES. H. J. Galbraith and J. F. Masi. Nov. 7, 1955. 32p. Contract [NOa(s)-52-1024-c].

Analyses are presented of published research reports on various kinetic studies of the pyrolysis, oxidation, hydrolysis, and ethenolysis of boron hydrides and borines. (C.W.H.)

1211 CCC-1024-TR-152
Arkansas. Univ., Fayetteville.
THE EFFECT OF SOLUTES ON THE PROPERTIES AND STRUCTURE OF LIQUID BORIC OXIDE. R. F. Kruh, K. H. Stern, and F. M. Hornyak. Nov. 11, 1955. 29p. [For Callery Chemical Co. Contract NOa(s)-52-1024-c].

Several properties (viscosity, density, dielectric constant, electrode potentials) of molten B_2O_3 and of solutions of inorganic substances in B_2O_3 were determined principally in the temperature range 500 to 800°C. Correlation of the observed properties in terms of the probable structure of molten B_2O_3 was attempted. (auth)

1212 CCC-1024-TR-157
Duquesne Univ., Pittsburgh.
THE REACTION OF TRIPHENYLSILYLPOTASSIUM WITH SOME ORGANOBORON COMPOUNDS. H. H. Szmant and J. M. Dixon. Nov. 25, 1955. 26p. [For Callery Chemical Co.] Contract [NOa(s) 52-1024-c].

The reactions between triphenylsilylpotassium and selected boron compounds gave, as the principal Si-containing compounds, triphenylsilanol and hexaphenyldisiloxane. The reaction between triphenylsilylpotassium and excess BF_3 yielded the triphenylsilanol–BF_3 complex as the main product. None of the expected compounds of the type $(C_6H_5)_3SiBR_2$ were obtained. Failure to obtain the desired B–Si bonded compounds, and the formation of compounds containing Si–O bonds, can be attributed to the fact that the B–Si bond is very weak (estimated bond energy, 20 kcal/mol). If such compounds were formed, they probably were readily subject to cleavage in O_2 or O-containing compounds. (auth)

1213 K-1232
Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.
FEASIBILITY OF LARGE-SCALE NITROGEN-15 PRODUCTION FOR NUCLEAR REACTORS. D. A. Hayford, W. N. Johnson, S. A. Levin, J. Shacter, and E. Von Halle. Aug. 17, 1955. 54p. Contract W-7405-eng-26.

Several processes are considered for the large-scale production of N^{15} for (homogeneous) nuclear reactors. It is concluded that one or several chemical exchange processes could be developed and a plant built to mass-produce 99 or 99.9% N^{15} at less than $5/gr, and possibly at close to $1/gr, including initial costs amortized at 20% per year. The cost of chemicals, usually dominating in this type of process, can be eliminated as a controlling factor. (auth)

1214 NP-5832
University of Southern Calif., Los Angeles.
STUDIES ON BORON HYDRIDES. Ninth Annual Technical Report on WATER-REACTIVE CHEMICAL COMPOUNDS. Period covered: November 1, 1954 through October 31, 1955. Anton B. Burg, Peter J. Slota, Jr., Gordon L. Juvinall, Francis M. Graber, James L. Boone, and Louis R. Grant. Nov. 1, 1955. 32p. Project No. NR-356-050. Contract N6onr-238-TO-I.

Several procedures have been developed for the preparation of dialkylphosphinoborine trimers. Investigations were continued on the reactions of diborane with ethylenimine and azetidine and the reactions of dimethylamine with 1,2-dimethyldiborane. Disproportionation was observed in the methanethio-methyl borines. (C.W.H.)

1215 NYO-1093
Foote Mineral Co., Philadelphia.
ZIRCONIUM METAL FINES RECOVERY. Interim Technical Report for May 15, 1950 to December 15, 1950. LOW HAFNIUM ZIRCONIUM PROJECT. S. C. Ogburn, Jr. and L. J. Reader. Jan. 24, 1951. Decl. June 10, 1955. 19p. Contract AT(30-1)-543.

This report covers the laboratory and pilot plant investigation of the reclamation of the low Hf-Zr fines resulting from the manufacture of Zr sponge and Zr crystal bar. The process investigated involved recovery of the Zr as $ZrCl_4$, by drying the fines in an atmosphere of N and subsequent chlorination of the fines with anhydrous HCl at temperatures above the sublimation point of the product. (J.E.D.)

1216 NYO-7214
Cornell Univ., Ithaca, N. Y.
STRUCTURES OF FLUOROCARBONS, ELEMENTARY BORON, AND BORON COMPOUNDS. Final Report. J. L. Hoard. July 1, 1955. 20p. Contract AT(30-1)-878.

The crystal structures of elementary boron and dimethylaminoborine dimer have been studied. It is shown that several fluorocarbons exhibit molecular rotation in the crystalline phases that are stable just below the melting point. (C.W.H.)

1217 UCRL-3072
California. Univ., Berkeley. Radiation Lab.
I. SAFE HANDLING OF LIQUID HYDROGEN IN THE LABORATORY. II. UCRL SAFETY PRECAUTIONS FOR THE HYDROGEN BUBBLE CHAMBER. C. R. Wintersteen and R. C. Mathewson. July 1955. 17p. Contract W-7405-eng-48.

1218 UCRL-3178
California. Univ., Berkeley. Radiation Lab.
REVISION OF THE FUNDAMENTAL CONSTANTS. Leo Brewer and Kenneth S. Pitzer. Oct. 1955. 3p. Contract W-7405-eng-48.

The following values for the fundamental constants are reported: R = 8.3147 ± 0.0001 joules/deg mole, 82.060 cc-atm/deg mole, 1.98726 cal/deg mole; N = $6.0230 \pm 0.0002 \times 10^{23}$ molecules/mole; k = $1.38049 \pm 0.00005 \times 10^{-16}$ ergs/deg molecule; h = $6.6254 \pm 0.0002 \times 10^{-27}$ ergs sec/molecule; c = $2.997928 \pm 0.000004 \times 10^{10}$ cm/sec; and F = 96,493.5 ± 2 coul/eq, 23,062.5 cal/volt eq. (C.W.H.)

1219 WADC-TR-55-26(Pt. II)
Rutgers Univ., New Brunswick, N. J.
RESEARCH ON BORON POLYMERS. PART II. POLYMER STUDIES. Conducted from June 1953 through November 1954. William L. Ruigh, Charles E. Erickson, Frank Gunderloy, and Michael Sedlak. May 1955. 84p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF 33(616)-2057.

Boron compounds and polymers have been studied in connection with the development of plastics and elastomers, which are thermally stable as well as oil and fuel resistant. The stable polymeric "boronamides" derived from boronic acids and bi-functional isocyanates have been shown to be essentially polyureas admixed with soluble boron compounds. Esters and polymers based on tricovalent boron are hydrolytically unstable. The diethanolamine ester of benzene-boronic acid has been prepared. It was stable to hydrolysis, and could be recrystallized from water. Allylboronic acid and its esters have been synthesized and studied primarily as intermediates for γ-dimethylaminopropane boronic acid. (See also WADC-TR-55-26(Pt. I).) (auth)

1220
THE IODIDE–IODINE–TRIIODIDE EQUILIBRIUM AND ION ACTIVITY COEFFICIENT RATIOS. Leonard I. Katzin and Elizabeth Gebert (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 77, 5814-19(1955) Nov. 20.

The triiodide dissociation constant is determined at 20, 25, and 30°C by measuring the solubility of iodine in

iodide solutions. It is demonstrated that the activity coefficient ratio of iodide and triiodide ions in the same solution is a function of solution composition, and the differences between different media are greater at higher ionic strengths. Entropy data for the three reactions, $X^- + I_2 \cdot H_2O = XI_2^- + H_2O$ are shown to be consistent with this formulation. (auth)

1221

THE SOLUTION OF CADMIUM IN LIQUID CADMIUM CHLORIDE. K. Grjotheim, F. Grönvold, and J. Krogh-Moe (Norwegian Inst. of Tech. and Univ. of Oslo, Sweden). J. Am. Chem. Soc. 77, 5824-7(1955) Nov. 20.

The melting point depression of Cd in $CdCl_2$ has been measured. From the results it is inferred that Cd probably forms Cd_2^{++} ions on dissolving in liquid $CdCl_2$. Related experimental data are discussed and found to support this view. It seems that also in other cases the formation of metal–metal bonds might be responsible for the solubility of a metal in its halides. (auth)

1222

PHYSICAL CHEMICAL STUDIES OF SOLUTIONS IN ANHYDROUS ETHYLENEDIAMINE. II. CONDUCTANCES AND VISCOSITIES OF SOLUTIONS OF MERCURIC BROMIDE, IODIDE AND CYANIDE. John Peacock, F. C. Schmidt, R. E. Davis, and W. B. Schaap (Indiana Univ., Bloomington). J. Am. Chem. Soc. 77, 5829-32(1955) Nov. 20.

The solubilities of $HgBr_2$, HgI_2, and $Hg(CN)_2$ in ethylenediamine at 25° have been found to be approximately 26, 300, and 113 g/100 g solvent respectively. Conductances of solutions of these salts have been measured at 25° over the available range of concentrations. The plots of equivalent conductance against concentration for HgI_2 and $Hg(CN)_2$ show minima and maxima. The plot for $HgBr_2$ shows only a minimum since the more concentrated solutions proved to be unstable and were not suitable for conductance measurements. The maxima in the conductance curves are probably due to the formation of triple ions or, perhaps, to formation of complex ions of HgX_4^{--} (X = Br^-, I^- or CN^-) at moderate concentrations followed by a rapid drop in conductance at higher concentrations due to the large increase in viscosity observed in this region. The exceptionally high solubility of the iodide is typical of the behavior of iodides in ethylenediamine and other amine solvents. It is tentatively suggested that this is due to the solvation of the iodide through the expansion of the outer valency shell of the iodine. (auth)

1223

THE RELATIVE STRENGTHS OF CERTAIN ACIDS IN LIQUID AMMONIA. George W. Watt, Donald M. Sowards, and William R. McBride (Univ. of Texas, Austin). J. Am. Chem. Soc. 77, 5835-7(1955) Nov. 20.

Potentiometric titrations of urea, thiourea and guanidinium acetate and chloride with potassium amide in liquid ammonia at −36°C show that the decreasing order of relative acidic strengths of the several acids involved in these systems is: $NH_4^+ > H_2NC(NH)NH_3^+ > H_2NC(S)NH_2 > H_2NC(O)NH_2 > H_2NC(NH)NH_2 > H_2NC(S)NH^- > H_2NC(O)NH^- > H_2NC(NH)NH^- > NH_2^-$. The monopotassium salts of guanidine, urea and thiourea are soluble in liquid ammonia, while the dipotassium salts are substantially insoluble. (auth)

1224

THE DEUTERIUM ISOTOPE EFFECT OF THE METHANOLYSIS OF SOME ORGANOMETALLIC COMPOUNDS. Kenneth B. Wiberg (Univ. of Washington, Seattle). J. Am. Chem. Soc. 77, 5987-90(1955) Nov. 20.

The 1-butyl, phenyl and benzyl Grignard and lithium reagents have been found to react with methanol-d_1 faster or as fast as with ordinary methanol. A similar isotope effect was noted in the reaction of methyl sodiopropionate with methanol. The results are compared with the data available in the literature. The isotope effect of the neutralization of the C-anion of mandelonitrile also was determined, and the rate law for the benzoin condensation has been reconsidered based on this evidence. (auth)

1225

THE CRYSTALLINE COMPOUND AMMONIA-BORANE, H_3NBH_3. Sheldon G. Shore and Robert W. Parry (Univ. of Michigan, Ann Arbor). J. Am. Chem. Soc. 77, 6084-5(1955) Nov. 20.

The compound ammonia-borane, H_3BNH_3, has been prepared from the "diammoniate of diborane" as a white, ether-soluble solid. Molecular-weight measurements indicate that H_3BNH_3 is a monomer. It's chemical properties contrast sharply with those of the "diammoniate of diborane." Powder pattern data are tabulated. (C.W.H.)

1226

STUDY OF ISOTOPIC EXCHANGE OF OXYGEN BETWEEN HEAVY OXYGEN WATER AND CERTAIN TUNGSTATES. V. I. Spitsyn, R. I. Aistova, and V. N. Vasil'ev. (Inst. of Physical Chemistry). Doklady Akad. Nauk S.S.S.R. 104, 741-3(1955) Oct. 11. (In Russian)

Water-O^{18} was used in the investigation of the sodium paratungstate $Na_{10}W_{12}.O_{41}.28H_2O$ structure. The results proved that in normal tungstate and in sodium paratungstate all the oxygen atoms are accessible for isotopic exchange of oxygen with water as solvent. During the exchange, the enrichment of paratungstate anion by heavy oxygen isotopes was observed, while in the normal tungstate ion no such phenomenon occurred. This indicates that the fractionation of oxygen isotopes depends not only on the mass of the hydrated elementary ions, but also, on the complex ion mass present in the solvent. (R.V.J.)

1227

NITRIC ACID-NITROGEN DIOXIDE-WATER SYSTEM. VAPOR PRESSURES AND RELATED PROPERTIES. Anderson B. McKeown and Frank E. Belles (Lewis Flight Propulsion Lab., Cleveland). Ind. Eng. Chem. 47, 2540-3 (1955) Dec.

The vapor pressures of the ternary system HNO_3–NO_2–H_2O were measured in the temperature range 10 to 80°C and for compositions containing >70% HNO_3. Ternary diagrams showing constant pressure lines as a function of the composition of acid are presented for three temperatures. (auth)

1228

PLASTICS FOR CORROSION-RESISTANT APPLICATIONS. Raymond B. Seymour and Robert H. Steiner. New York, Reinhold Publishing Corp., 1955. 423p.

Information is presented on plastic materials of construction, thermoplastic applications, application of plastics in masonry construction, and the selection for the solution of corrosion problems. (J.E.D.)

1229

STREAMING POTENTIAL STUDIES. QUARTZ FLOTATION WITH CATIONIC COLLECTORS. A. M. Gaudin and D. W.

Fuerstenau. Mining Eng. 7, 958-62(1955) Oct.

By streaming potential techniques, the zeta potential of quartz has been measured as a function of the concentration of dodecylammonium salts at different pH values. These experiments indicate that adsorption of dodecylammonium ions takes place as individual aminium ions until a certain critical concentration is reached in the double layer, at which point the adsorbed collector ions begin to associate into patches of ions, called hemimicelles. Because of its effect on the surface potential or quartz, pH controls the adsorption of dodecylammonium ions. The value of cooperating agents and nonionized constituents of flotation systems is discussed. (auth)

ANALYTICAL PROCEDURES

1230 AECD-3674

Los Alamos Scientific Lab., N. Mex.

COLLECTED RADIOCHEMICAL PROCEDURES. J. W. Barnes, N. A. Bonner, C. I. Browne, D. C. Hoffman, H. A. Potratz, H. L. Smith, B. Warren—Jacob Kleinberg, comp. Sept. 10, 1954. Decl. with deletions Sept. 20, 1955. 66p. Contract W-7405-eng-36.

Analytical procedures are presented for the determinations of Th^{230}, Pa^{233}, U^{237}, U^{235}, Np, Pu, Am, and Cm in fission-product material. (C.W.H.)

1231 AECD-3710

Knolls Atomic Power Lab., Schenectady, N. Y.

ANALYTICAL STUDIES ON THE ESTIMATION OF BERYLLIUM OXIDE IN BERYLLIUM METAL. J. Rynasiewicz. Apr. 17, 1951. Decl. with deletions Nov. 21, 1955. 15p. Contract W-31-109-Eng-52.

The estimation of BeO in Be metal depending on the differential solubilities of the two materials in dilute HCl is presented. Alternate methods are described, and the limitations and possible errors are discussed. (auth)

1232 AERE-C/R-1725

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF RUBIDIUM AND CAESIUM IN SODIUM–POTASSIUM ALLOYS AND RELATED MATERIALS BY RADIOACTIVATION. M. J. Cabell and A. Thomas. Sept. 1955. 14p.

The method described by Smales and Salmon for the determination of rubidium and caesium in sea-water and related materials has been extended in scope by the introduction of a step involving the separation of the alkali metals by cation exchange chromatography. This innovation makes possible the accurate determination of rubidium in the presence of large quantities of potassium and the determination of caesium in the presence of large quantities of potassium and the determination of caesium in the presence of large quantities of rubidium. The application of the method to the analysis of sodium-potassium alloys and potassium hydroxide and chloride is described in detail. (auth)

1233 AERE-C/R-1749

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

APPLICATIONS OF DIFFERENTIAL SPECTROPHOTOMETRY TO THE DETERMINATION OF URANIUM IN VARIOUS BINARY AND TERNARY URANIUM BASE ALLOYS. A. Bacon and G. W. C. Milner. Sept. 20, 1955. 23p.

High-precision spectrophotometry was applied to the determination of the uranium contents of binary and ternary uranium base alloys containing zirconium, molybdenum, titanium and niobium as alloying constituents. In most cases absorbancy measurements were taken at 430 mμ on solutions of the samples in 3.6M sulfuric acid, but for alloys containing niobium it proved necessary to make the solutions 0.2M in oxalic acid to prevent the hydrolysis of this element from solution. This technique has been applied to alloys with uranium contents of 40% and higher, and over this range a standard deviation of ±0.1% uranium was attained. Strict controls are necessary, however, which make this technique more suitable for the analysis of batches of samples rather than for the occasional samples. (auth)

1234 AWRE-O-14/55

Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.

THE SPECTROGRAPHIC DETERMINATION OF CALCIUM, STRONTIUM AND SODIUM IN BARIUM NITRATE BY THE LUNDEGARDH METHOD. F. J. Thomason. May 3, 1955. 20p.

The application of Lundegardh's mist-in-flame technique to the analysis of trace impurities in barium nitrate, using a Hilger medium quartz spectrograph, was studied. The method involves preparing a 1% aqueous solution of the sample and atomizing this into a mist which is fed into an acetylene flame. Calcium, Sr, and Na may be determined over the range 0.001 to 0.1%. (auth)

1235 DP-76

Du Pont de Nemours (E. I.) and Co. Savannah River Lab., Augusta, Ga.

CONDUCTOMETRIC ACIDIMETRY IN THE PRESENCE OF HYDROLYZABLE IONS. R. C. Propst. June 1955. 31p. Contract AT(07-2)-1.

The sensitivity of the conductometric method for free acid in the presence of hydrolyzable ions (i.e. U^{4+}) was increased by employing an electrode system that had a large cell constant and by selecting a sample size that gave an optimum change in solution resistance per increment of titrant. The procedure that was developed was used to determine the free acidity of samples 0.01M in nitric acid and 1.5M in $Al(NO_3)_3$ with a relative standard deviation of ±14%. (auth)

1236 ISC-596

Ames Lab., Ames, Iowa.

TITRIMETRIC DETERMINATION OF ZIRCONIUM. M. O. Fulda and J. S. Fritz. Mar. 1955. 25p. Contract W-7405-eng-82.

A titrimetric method is described for the determination of Zr in zircon sands and Zr alloys. It is carried out in acid solution with EDTA (disodium dihydrogen ethylenediamine). Alizarol cyanone RC gave a sharp visible end point. Interfering metals included Th, Bi, Sb, and W. A literature survey is presented of other analytical procedures for the determination of Zr. 70 references. (C.W.H.)

1237 KAPL-192

Knolls Atomic Power Lab., Schenectady, N. Y.

THE DETERMINATION OF SULFAMIC ACID BY TITRATION WITH SODIUM NITRITE. Mary E. Brennan and

John F. Flagg. May 25, 1949. Decl. Nov. 22, 1955. 15p. Contract W-31-109-Eng-52.

Sulfamic acid can be determined by a potentiometric titration with a strong acid solution of sodium nitrite. Iron, Fe^{3+}, which would interfere in the titration, is removed by oxidation to Fe^{3+} and subsequent alkaline precipitation. (C.W.H.)

1238 KAPL-1425

Knolls Atomic Power Lab., Schenectady, N. Y.

DETERMINATION OF MICROGRAM QUANTITIES OF BARIUM IN SODIUM. D. Dutina. June 1, 1955. 19p. Contract W-31-109-Eng-52.

A method has been described by which Ba present in Na in concentrations as low as 250 ppm may be determined quantitatively. The method involves the precipitation of Ba as the chromate followed by spectrophotometric measurement of chromium concentration. (C.W.H.)

1239 M-4245

Princeton Univ., N. J. Frick Chemical Lab.

THE POLAROGRAPHIC DETERMINATION OF URANIUM—APPLICATION TO LOW-GRADE COMPLEX MATERIALS. N. H. Furman and G. P. Haight, Jr. 1946. Revised Oct. 1947. Decl. Nov. 18, 1955. 32p.

This report is based on Madison Square Information Reports A-1060 and A-1064.

A procedure is presented for the polarographic determination of U in ores containing also Fe, V, and Mo, and in process solutions containing trace amounts of U. (C.W.H.)

1240 ORNL-1951

Oak Ridge National Lab., Tenn.

PROCEDURES FOR THE ANALYSIS OF SOME RADIONUCLIDES ABSORBED ON SOIL. Bernd Kahn. Oct. 14, 1955. 20p. Contract W-7405-eng-26.

A procedure is presented for the determination of radionuclides of Cs, Sr, Y, the lanthanum rare earths, Ru, Zr, Nb, and Co, which have been adsorbed on soil. The radionuclides are leached from the soil with nitric, sulfuric, or a combination of oxalic and hydrochloric acids; isotopic carriers are added to the leach solutions; and the carriers and radioisotopes are purified by a series of precipitations. (auth)

1241 USNRDL-TR-62

Naval Radiological Defense Lab., San Francisco.

FLAME PHOTOMETRIC DETERMINATION OF Na, K, Ca, Mg, AND Sr IN SEA WATER. M. Honma. Sept. 15, 1955. 23p. Project NS-081-001.

In the determination of many alkali and alkaline-earth metals, conventional analytical procedures are both time-consuming and difficult. Moreover, chemical treatment is not feasible when many analyses for both cations and anions are necessary from a small sample. A rapid, flame photometric procedure was developed by which Na, K, Mg, and Ca values are obtained directly from small volumes of sea water without chemical processing. Hazards from radioactive fumes are avoided by the use of auxiliary apparatus. The strontium determination is made in the presence of calcium after chemical separation because of sodium interference. The flame photometric results compare favorably in accuracy with those from gravimetric procedures and data available in the literature. Radiation and interaction interferences have been accounted for. (auth)

1242 WAL-120/73-1

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

METHODS OF SEPARATION OF TOTAL RARE EARTHS IN LOW-ALLOY CONSTRUCTIONAL STEELS. Final Technical Report. W. A. Dupraw. Nov. 2, 1955. 48p. ARF Project No. C-064. Contract DAI-11-022-ORD-(P)-6.

In ferrous alloys, direct precipitation of rare earth fluorides with fluoboric acid is not effective when the rare-earth content is low. Investigations were initiated on ion-exchange separation methods. (See also WAL-120/73.) (C.W.H.)

1243 AEC-tr-2352

PHOTOCOLORIMETRIC DETERMINATION OF FLUORINE IN FERTILIZERS. K. Lasiewicz. Translated from Przemysl Chem. 33, 36-8(1954). 7p.

A photocolorimetric method of determining F_2 in raw phosphates and phosphorous fertilizers based on reduction of color intensity of the system $Ti-H_2O_2$ has been worked out. The influence of time, temperature, H_2SO_4, and H_2O_2 on the method has been determined. The method can be used for serial analysis in production control of superphosphate and thermophosphates. (auth)

1244 AERE-Lib/Trans-528

THE DETERMINATION OF EQUIVALENT AND MOLECULAR WEIGHT BY POTENTIOMETRIC MICROTITRATION IN NON-AQUEOUS SOLVENTS. Hans Brockman and Ernst Meyer. Translated by F. Hudswell from Chem. Ber. 86, 1514-22(1953). 14p.

The potentiometric titration of weak acids in non-aqueous solvents has been developed into a micro-method and used as a differential titration for the determination of equivalent and molecular weights of new naturally occurring substances. (auth)

1245

RAPID TITRIMETRIC DETERMINATION OF MICROGRAM AMOUNTS OF FLUORIDE ION WITH SPADNS-THORIUM LAKE. Gurupada Banerjee (Darjeeling Government Coll., India). Anal. Chim. Acta 13, 409-14(1955) Nov.

A rapid titrimetric method has been developed for the determination of microgram amounts of F^- ions in the range from 1 to 100 μg. Sodium fluoride solutions are titrated with $Th(NO_3)_4$ solutions containing SPADNS (sodium salt of 2-(p-sulfophenylazo)-1,8-dihydroxynaphthalene-3,6-disulfonic acid) as the indicator; an excess of Th^{4+} solution gives a sharp color change from scarlet red to blue violet. (C.W.H.)

1246

PAPER CHROMATOGRAPHY OF INORGANIC IONS. XII. THE SEPARATION OF Be, Ge, In AND Ga. R. G. de Carvalho and M. Lederer (Institut du Radium, Paris). Anal. Chim. Acta 13, 437-8(1955) Nov.

A paper chromatographic separation of Be, Ge, In, and Ga is described, and the behavior of these elements in butanol–HCl systems is discussed. (auth)

1247

COULOMETRIC TITRATION OF URANIUM WITH ELECTROGENERATED TITANOUS ION. James J. Lingane and Reynold T. Iwamoto (Harvard Univ., Cambridge). Anal. Chim. Acta 13, 465-72(1955) Nov.

In a citrate medium of pH 0.5 to 1.5, UO_2^{2+} can be titrated to U^{4+} with Ti^{3+} ions generated by reduction of Ti^{4+}

at a Hg cathode. By titrating at 85°C equilibrium is quickly established, and the equivalence point determined by potentiometric technique. This method is sufficiently accurate to serve for precise assays of macro amounts of U. (auth)

1248

FLAME SPECTRA OF TWENTY METALS USING A RECORDING FLAME SPECTROPHOTOMETER. Marvin Whisman and Barton H. Eccleston (Bureau of Mines, Bartlesville, Okla.). Anal. Chem. 27, 1861-9(1955) Dec.

A flame spectrophotometric procedure is presented for the determination of metals present in trace quantities in Diesel fuels. Modifications in a flame spectrophotometer for this procedure are described and spectrograms of Na, Sr, Mn, Ca, Li, Tl, Cu, Ag, Cr, Ni, K, Ba, Fe, Rb, Co, Mg, Ti, B, V, and Pb are given with tables of the principal flame lines and an estimated detection limit for each of the metals. (C.W.H.)

1249

QUANTITATIVE DETERMINATION OF THORIUM AND URANIUM IN SOLUTIONS BY FLUORESCENT X-RAY SPECTROMETRY. George Pish and Audrey A. Huffman (Mound Lab., Miamisburg, Ohio). Anal. Chem. 27, 1875-8 (1955) Dec.

An x-ray fluorescent spectrometric method has been developed in which aqueous and organic solutions can be analyzed directly for Th and U. Sample preparation requires only the addition of a suitable internal standard added as a solution. A sample can be analyzed for both Th and U in 0.5 hr or less. (auth)

1250

COMBINED RADIOMETRIC AND FLUORESCENT X-RAY SPECTROGRAPHIC METHOD OF ANALYZING FOR URANIUM AND THORIUM. William J. Campbell and Howard F. Carl (U. S. Bureau of Mines, College Park, Md.). Anal. Chem. 27, 1884-6(1955) Dec.

Employing radioactivity measurements and fluorescent x-ray spectroscopy, a rapid method of analyzing ores for U and Th has been developed. The total radioactivity of U and Th is determined and expressed as per cent equivalent U. From the line intensity ratio ULα/ThLα measured by fluorescent x-ray spectroscopy the weight ratio of U to Th is calculated. As the relative radioactivity of U to Th is known, the weight per cent of U and Th can be calculated. The time required is approximately 20 min. per analysis for both elements. The accuracy is ±10% of the amount present in samples containing more than 0.5% of the elements and the lower limit of detection is 0.01 to 0.03% of either element. (auth)

1251

POLAROGRAPHIC BEHAVIOR OF MONOHALOACETONES. ANALYSIS OF MIXTURES. Philip J. Elving and Robert E. Van Atta (Pennsylvania State Univ., University Park). Anal. Chem. 27, 1908-13(1955) Dec.

The polarographic behavior of the three monohalogenated acetones—iodoacetone, bromoacetone, and chloroacetone—has been investigated in order to determine the relationship of half-wave potential, $E_{1/2}$, and diffusion current, i_d, to pH, ionic strength and buffer concentration effects, the probable nature of the reduction, and the extent of applicability of polarography as a method of analysis for such compounds, individually and in mixture. (auth)

1252

IMPROVEMENTS IN ISOTOPIC CARBON ASSAY AND CHEMICAL ANALYSIS OF ORGANIC COMPOUNDS BY DRY COMBUSTION. David R. Christman, Nancy E. Day, Patricia R. Hansell, and R. Christian Anderson (Brookhaven National Lab., Upton, N. Y.). Anal. Chem. 27, 1935-9(1955) Dec.

Important modifications have been made in the apparatus by which micro samples of organic compounds are burned to CO_2 and H_2O, the latter being measured in a low pressure gas manometer and then employed directly for isotopic assay. The alterations are chiefly in the combustion tube and filling, the removal of nitrogen oxides, the trap and manometer system, and the isotopic assay for C^{14}. (auth)

1253

INHERENT ERRORS AND LOWER LIMIT OF ACTIVITY DETECTION IN GAS-PHASE PROPORTIONAL COUNTING OF CARBON-14. David R. Christman and Alfred P. Wolf (Brookhaven National Lab., Upton, N. Y.). Anal. Chem. 27, 1939-41(1955) Dec.

The precision of the method of C^{14} assay used in this laboratory, by measurement with gas proportional counters, is discussed from the standpoint of the identity and magnitude of the various errors involved. The lower limit of activity detection in these gas proportional counting tubes has been investigated. (auth)

Refer also to abstracts 1307, 1316, and 1402.

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

1254

ON THE ANOMALY OF ATOMIC WEIGHTS IN MENDELEEV'S PERIODIC SYSTEM. G. P. Maitak. Zhur. Obshchei Khim. 25, 2017-23(1955) Nov. (In Russian)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1255 AEC-tr-2348

INVESTIGATION OF MIXED CRYSTALS III. M. M. Popov, S. M. Skuratov, and Z. N. Nikonova. Translated from Zhur. Obshchei Khim. 10, 2017-22(1940). 19p.

The methods for determination of the mean heat capacities of solids with particular reference to mixed crystals are discussed. Block calorimeters with a resistance thermometer on the surface and a Bowden mercury thermometer in a closely fitting well were used. Adiabatic block calorimeters were applied in checking the results. Preliminary data indicate that the heat capacity (20 to 650°C) in mixed crystals (50% (K,Na)Cl and 60% K(Cl,Br)) is greater than the figure calculated from the additivity rule by 0.6 and 0.8%, respectively. The rate of decomposition of the mixed crystals 50% (K,Na)Cl is negligible at room temperature and therefore the crystal may be considered practically stable. The thermal equivalent of the calorimetric system and the heat capacities of potassium bromide and potassium iodide solutions were determined electrically with the use of Raps compensator and a mirror galvanometer. Data on the heats of solutions of the components, salt mixtures and various crystals are tabulated. (R.V.J.)

Refer also to abstract 1427

FLUORINE AND FLUORINE COMPOUNDS

1256 AERE-C/R-1735

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PREPARATION OF THORIUM TETRAFLUORIDE BY THE THERMAL DEGRADATION OF THE HYDRATE. R. W. M. D'Eye, G. W. Booth, and E. A. Harper. Sept. 8, 1955. 5p.

Monoclinic thorium tetrafluoride can be prepared by degrading the hydrate in an inert atmosphere at 400°. At 300° both in air and in vacuo a small particle size product is formed which could be either a hydrate of low water content or another form of the tetrafluoride together with adsorbed water. (auth)

1257 AEC-tr-2353

ORGANIC REACTIONS OF FLUORINE IN MODERN CHEMISTRY. Zdzislaw Szymusik. Translated from Chemik 7, 279-81(1954). 12p.

Basic fluorine chemistry and applications are reviewed. The preparation, and properties of fluorine derivatives, with emphasis on the freons, are discussed. (C.W.H.)

1258

X-RAY STUDIES ON THE SYSTEM BiF_3–Bi_2O_3. I. PRELIMINARY PHASE ANALYSIS AND A NOTE ON THE STRUCTURE OF BiF_3. Bengt Aurivillius (Univ. of Stockholm, Sweden). Acta Chem. Scand. 9, No. 7, 1206-8(1955).

After heating BiF_3 in air, it is found that the fluorine content gradually decreased, the end product being Bi_2O_3. The cell dimensions, a = 6.56 A, b = 7.04 A, and c = 4.83 A were determined for the BiF_3 crystal. Phase studies were initiated on the BiF_3–Bi_2O_3 system. (C.W.H.)

1259

X-RAY STUDIES ON THE SYSTEM BiF_3–Bi_2O_3. II. A BISMUTH OXIDE FLUORIDE OF DEFECTIVE TYSONITE TYPE. Bengt Aurivillius and Thomas Lundqvist (Univ. of Stockholm, Sweden). Acta Chem. Scand. 9, No. 7, 1209-12 (1955).

The bismuth oxide fluoride of approximate composition $BiO_{0.1}F_{2.8}$ was prepared by heating BiF_3 in air at 840°C. The cell dimensions, a = 4.08 A and c = 7.32 A and density = 8.3 were determined. The crystal structure is closely related to that of tysonite. (C.W.H.)

1260

PRODUCTION OF FLUORINE-18. H. O. Banks, Jr. (Brookhaven National Lab., Upton, New York). Nucleonics 13, No. 12, 62(1955) Dec.

The production of F^{18} by means of the reaction $_3Li^6 + _0n^1 \rightarrow _1H^3 + _2He^4$; $_1H^3 + _8O^{16} \rightarrow _0n^1 + _9F^{18}$ has been repeated and verified. The production procedure is described in detail. (B.J.H.)

1261

THE CONDENSED SYSTEM BROMINE TRIFLUORIDE–ANTIMONY PENTAFLUORIDE. J. Fischer, R. Liimatainen, and J. Bingle (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 77, 5848-9(1955) Nov. 20.

Investigation of the system BrF_3–SbF_5 has shown the presence of two incongruently melting compounds, $3BrF_3 \cdot SbF_5$ and $3BrF_3 \cdot 2SbF_5$, and two congruently melting compounds, $BrF_3 \cdot SbF_5$ and $BrF_3 \cdot 3SbF_5$. The compound $BrF_3 \cdot 3SbF_5$ undergoes a solid phase transition at −22.6°C. (auth)

1262

THE PHYSICAL PROPERTIES OF SOME FLUORINE COMPOUNDS AND THEIR SOLUTIONS. PART 1. SULPHUR HEXAFLUORIDE. H. P. Clegg, J. S. Rowlinson, and J. R. Sutton (Univ. of Manchester, England). Trans. Faraday Soc. 51, 1327-33(1955) Oct.

The following properties of SF_6 have been measured: (i) the vapor pressure from 0°C to the critical point, (ii) the orthobaric densities from 20°C to the critical point, (iii) the critical constants, and (iv) the density in the one-phase region from 34 to 131°C and up to 100 atm pressure, from which the second and third virial coefficients have been calculated. These properties are compared with those of the inert gases by means of the principle of corresponding states. It is shown that the differences can be accounted for by a perturbation treatment previously developed to allow for the effect of orientational intermolecular forces on equilibrium properties. The significance of this agreement is discussed. (auth)

1263

THE PHYSICAL PROPERTIES OF SOME FLUORINE COMPOUNDS AND THEIR SOLUTIONS. PART 2. THE SYSTEM SULPHUR HEXAFLUORIDE + PROPANE. H. P. Clegg and J. S. Rowlinson (Univ. of Manchester, England). Trans. Faraday Soc. 51, 1333-40(1955) Oct.

The pressure and density of the liquid and vapor phases of six mixtures of SF_6 and propane have been measured from 21°C to the critical points. The system shows: (i) large positive deviations from Raoult's law, forming an azeotrope at a mole fraction of propane of about 0.15; (ii) a minimum in the graph of critical (or plait-point) temperature against composition at about the same mole fraction of propane; (iii) both minimum and maximum in a similar graph of the critical pressure; (iv) maxima in the volumes of the orthobaric liquid densities and in the critical volume, and (v) a small amount of retrograde behavior in mixtures rich in propane. These deviations from the laws of ideal solutions are large for a mixture of substances of almost identical critical volumes and similar critical temperatures, and are consistent with the interaction energy between a molecule of SF_6 and one of propane being weaker than that between molecules of either pure substance. Both the arithmetic mean and the cube of the difference of the orthobaric densities of these mixtures are linear functions of the temperature as for pure substances. (auth)

1264

INFRARED AND RAMAN SPECTRA OF FLUORINATED ETHYLENES. VI. FLUOROTRICHLORETHYLENE. J. Rud Nielsen, C. W. Gullikson, and A. H. Woollett (Univ. of Oklahoma, Norman). J. Chem. Phys. 23, 1994-6(1955) Nov.

The infrared spectrum of gaseous CCl_2 CClF has been observed from 2 to 22μ with NaCl and KBr prisms. The Raman spectrum of the liquid has been photographed with a three-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A, and the depolarization ratios of the stronger Raman bands have been measured. All but one of the fundamental vibration frequencies have been assigned, and the spectra have been interpreted in detail. (auth)

1265

HEAT CAPACITY OF ZINC FLUORIDE FROM 11 TO 300°K. THERMODYNAMIC FUNCTIONS OF ZINC FLUORIDE. ENTROPY AND HEAT CAPACITY ASSOCIATED WITH THE ANTIFERROMAGNETIC ORDERING OF MANGANOUS FLUORIDE, FERROUS FLUORIDE,

COBALTOUS FLUORIDE, AND NICKELOUS FLUORIDE. J. W. Stoud and Edward Catalano (Univ. of Chicago). J. Chem. Phys. 23, 2013-22(1955) Nov.

The heat capacity of ZnF_2 has been measured calorimetrically between 11 and 300°K. In addition to the direct experimental data, values of heat capacity, entropy, enthalpy, and free energy are tabulated at selected temperatures. The values of entropy and enthalpy at 298.16°K are $S^0 = 17.61 \pm 0.03$ cal deg^{-1} $mole^{-1}$ and $H^0 - H_0^0 = 2827 \pm 5$ cal $mole^{-1}$. The heat capacity of ZnF_2 has been used, with a corresponding states argument, to estimate the lattice contributions to the entropy and heat capacity of the isomorphous fluorides MnF_2, FeF_2, CoF_2, and NiF_2 which exhibit heat capacity maxima associated with antiferromagnetic ordering at 66.5, 78.35, 37.70, and 73.22°K, respectively. The values of electronic entropy at the maximum in heat capacity are: MnF_2, 0.85R ln6; FeF_2, 0.87R ln5; CoF_2, 0.80R ln2; NiF_2, 0.71R ln3. The electronic entropies and heat capacities are compared with molecular field and spin wave theories of antiferromagnetism. At very low temperatures the electronic heat capacity on NiF_2 is varying approximately as $T^{3/2}$ whereas that of the other antiferromagnetic fluorides depends much more strongly on temperature. This behavior of the electronic heat capacity of NiF_2 is believed to be associated with the small ferromagnetic moment found in magnetic anisotropy measurements on this salt. (auth)

1266

VIBRATIONAL SPECTRUM OF 1-FLUORO-1-CHLOROETHYLENE. D. E. Mann, N. Acquista, and Earle K. Plyler (National Bureau of Standards, Washington, D. C.). J. Chem. Phys. 23, 2122-6(1955) Nov.

The infrared spectrum of gaseous $FClCCH_2$ has been investigated in the range 1.6 to 52μ. A satisfactory vibrational assignment has been achieved. The planar fundamentals occur at 3069, 3016, 1656, 1383, 1186, 947, 699, 432, and 371 cm^{-1}; the out-of-plane fundamentals are at 836, 607, and 515 cm^{-1}. A table of the thermodynamic functions for the ideal gas is given from 200 to 1500°K. (auth)

Refer also to abstracts 1201, 1216, 1243, 1245, 1264, 1265, and 1266.

GRAPHITE

1267 RL-12.6.17

California. Univ., Berkeley. Radiation Lab.

GRAPHITE TESTS. Clarence H. Dibble. July 31, 1944. Decl. June 29, 1954. 12p.

Room temperature strength and machinability tests were carried out on several graphite samples. (C.W.H.)

1268 WADC-TR-53-457

Battelle Memorial Inst., Columbus, Ohio.

MOLYBDENUM DISILICIDE COATING FOR GRAPHITE. J. F. Lynch, J. A. Slyh, and W. H. Duckworth. Sept. 1954. 31p. Contract AF33(038)-841. (AD-53654)

A protective coating for graphite was developed. Basic features of the process consist of applying molybdenum disilicide powder suspended in a phenolic-resin vehicle on the graphite surface, curing, and then heating in a neutral or reducing atmosphere at 3900 to 4000°F. The result is a dense, adherent, glazelike surface. It significantly protected graphite when tested as nozzles in a hot, high-velocity stream of oxidizing gases. The major phase in the matured coating is a molybdenum-silicon carbide. Silicon carbide is present in a lesser amount. (auth)

1269

IRRADIATION OF GRAPHITE AT LIQUID HELIUM TEMPERATURES. Stanley B. Austerman and John E. Hove (North American Aviation, Downey, Calif.). Phys. Rev. 100, 1214-15(1955) Nov. 15.

Bombardments of graphite at liquid helium temperatures with 1.25-Mev electrons are described. After irradiation, the pulse annealing characteristics are observed and are compared to those observed after proton and neutron irradiation. It is concluded that no new type of damage center is introduced by this irradiation. (B.J.H.)

1270

INTERPRETATION OF THE STORED ENERGY OF IRRADIATED GRAPHITE IN TERMS OF ELASTIC ENERGY ASSOCIATED WITH MICROSCOPIC STRAINS. Alfred E. Austin and Ralph J. Harrison (Battelle Memorial Inst., Columbus, Ohio). Phys. Rev. 100, 1225-6(1955) Nov. 15.

The amount of contraction of the a_0 dimension of irradiated graphite and its behavior on annealing have been determined with greater precision than earlier determinations. It is shown that the observed intralayer distortions have more the character of strains than crystal breakup. Mean square strain and computed stored energy for graphites are tabulated. (B.J.H.)

LABORATORIES AND EQUIPMENT

1271 AERE-CE/R-1730

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A MICRO-MIXER-SETTLER FOR LABORATORY CONTINUOUS COUNTER-CURRENT SOLVENT EXTRACTION. G. P. Wall. July 25, 1955. 19p.

A micro-mixer-settler has been developed giving a 100% stage efficiency with the systems studied. Two sizes are available having stage volumes of 12 mls and 30 mls. (auth)

MOLECULAR STRUCTURE

Refer to abstract 1244.

RADIATION CHEMISTRY

1272

RADIOLYSIS OF AQUEOUS SOLUTIONS OF HYDRAZINE. H. A. Dewhurst and Milton Burton (Univ. of Notre Dame, Ind.). J. Am. Chem. Soc. 77, 5781-5(1955) Nov. 20.

In the radiolysis of air-free hydrazine solutions with Co^{60} gammas at room temperature, 100 ev yields are substantially independent of hydrazine concentrations above 2×10^{-2}M; the values are $G(-N_2H_4) = G(NH_3) = 5.2$; $G(N_2) = G(H_2) = 2.5$. The ratio of the calculated rate constants for the reactions $H + H_2O_2 \rightarrow H_2O + OH$ and $H + N_2H_5^+ \rightarrow H_2 + N_2H_4^+$ is 2×10^3. (auth)

1273

RADIATION CHEMISTRY OF THE AQUEOUS FORMIC ACID-FERRIC SULFATE SYSTEM. Edwin J. Hart

(Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 77, 5786-8(1955) Nov. 20.

A study of the γ-ray induced reaction between HCOOH and ferric sulfate is reported in the pH range from 0.3 to 2.5. Radiation yields G_{CO_2}, G_{H_2} and $G_{Fe^{++}}$ are given as a function of HCOOH and ferric sulfate concentrations. The reactions are dependent on the relative HCOOH/Fe^{3+} ratios. At low ratios of these reactants, the stoichiometry is expressed by: $2Fe^{+++} + HCOOH = 2Fe^{++} + 2H^+ + CO_2$. At high ratios, the reaction is: $2Fe^{+++} + 2HCOOH = 2Fe^{++} + 2CO_2 + H_2 + 2H^+$. The mechanism is discussed in terms of free radical reactions involving hydrogen, hydrogen molecule ion, hydroxyl, and formate free radicals. (auth)

1274

PEROXIDE YIELD IN THE γ-IRRADIATION OF AIR-SATURATED WATER. Augustine O. Allen and Richard A. Holroyd (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 77, 5852-5(1955) Nov. 20.

The peroxide yield decreases in air-saturated γ-irradiated water on the addition of Br^- ion at pH = 2 and 5. These results confirm previous investigations by Sworski (J. Am. Chem. Soc. 76 4687(1954)). (C.W.H.)

1275

THE EFFECTS OF IONIZING RADIATION ON AQUEOUS SOLUTIONS OF CYSTEAMINE AND CYSTAMINE. B. Shapiro and L. Eldjarn (Norweigian Radium Hosp., Oslo, Norway). Radiation Research 3, 255-66(1955) Nov.

Aqueous solutions of S^{35}-labled cysteamine and cystamine were irradiated by means of a Co^{60} source and a 175-kv x-ray machine. The products formed by the irradiation were resolved by paper chromatography and identified. Irradiation of cysteamine solutions resulted in oxidation to cystamine at pH 3.0 and 5.0 with G values of 3.6 to 5.0 and 11 to 20, respectively. Three products were isolated from irradiated solutions of cystamine and identified as cysteamine, 2-aminoethane sulfinic acid, and taurine. The G values for the latter two were 0.8 to 1.2 and 0.4 to 1.1, respectively, varying inversely with dosage. The yields of the products were measured under different conditions of dose, dose rate, concentration and pH of the solutions, temperature, and source of radiation. The findings are discussed in relation to the x-ray protective activity of the compounds and to the mechanism of radiation damage. (auth)

1276

EFFECTS OF GAMMA RAYS ON SOLUTIONS OF SODIUM DEOXYRIBONUCLEATE. POSSIBLE CHEMICAL MECHANISM FOR THEIR BIOLOGICAL EFFECTS. R. A. Cox, W. G. Overend, A. R. Peacocke, and S. Wilson (Univ. of Birmingham, England). Nature 176, 919-21(1955) Nov. 12.

1277

CHEMICAL SYNTHESIS CONSECUTIVE TO THE ACTION OF IONIZING RADIATION. J. Loiseleur. J. chim. phys. 52, 626-33(1955) Sept. (In French)

The synthesizing power of ionizing radiations results from the interaction of three factors: the primary radio-oxidation, the after effects during which this radio-oxidation develops its effects, and finally, the essential interaction of the molecular weight of the irradiated molecule. X rays thus lead to numerous syntheses (coloring matters, condensation of amino acids, new method of synthesizing urea.) (tr-auth)

Refer also to abstracts 1285, 1308, and 1309.

RADIATION EFFECTS

1278

REDUCTION OF AQUEOUS SOLUTIONS BY IRRADIATION. Gabriel Stein (Hebrew Univ., Jerusalem, Israel). J. chim. phys. 52, 634-44(1955) Sept. (In French)

An examination is made of the reductions produced by irradiating solutions in which the reducing agents are free organic radicals. The reduction of methylene blue, of cytochrome C, and of coenzyme I show the specific actions of the various radicals. The mechanism of the reactions initiated in the case of DPN and of N-alkyl nicotinamides is discussed on the basis of recent experimental results. The reactions induced by the radiations are compared to the enzymatic processes and to those where the reducing agents are hydrosulfite and boron hydride. (tr-auth)

1279

RADIOLYSIS OF DILUTE SOLUTIONS OF DIPHENYL-PICRYLHYDRAZYLE (DPPH) IN ORGANIC SOLVENTS. L. Bouby and A. Chapiro (Faculte des Sciences, Paris). J. chim. phys. 52, 645-56(1955) Sept. (In French)

Radiation cells containing solutions of DPPH were placed at various distances from a 25 curie radiocobalt source. Results show that the kinetics of the consumption of DPPH during radiolysis are qualitatively alike in the presence of air and under vacuum. However, certain differences show that oxygen plays a role at a certain phase of the reaction. (B.J.H.)

1280

THE EFFECTS OF γ RADIATION ON THE CHLORINATION OF AROMATIC HYDROCARBONS. David E. Harmer, Joseph J. Martin, and Leigh C. Anderson (Univ. of Michigan, Ann Arbor). J. chim. phys. 52, 667-76(1955) Sept. (In French)

It is well known that ultraviolet radiations assist the addition of chlorine to the benzene nucleus. In the presence of intense γ radiation from 0.3 and 3.0 kilocurie Co^{60} sources, the reaction takes place at such a high rate that it was necessary to dilute the reacting mixture with carbon tetrachloride and to operate with very efficient cooling in order to control the reaction. Chlorine can react with toluene in three ways: by H substitution in the nucleus; by H substitution in the lateral chain; and by saturation of the aromatic nucleus by addition of three halogen molecules. This last reaction is practically unknown in literature, though in the presence of γ radiation, chlorine attaches itself to the nucleus in quantities greater than that which is substituted on the lateral chain. The speed of the substitution reaction seems to vary with the square root of the radiation intensity for intensities between 7.9 and 28.4 kilorep per hour, while the speed of addition increases a little more rapidly with intensity. The addition reaction seems, then, to be assisted by the use of high intensities. The data from the experiments in which the chlorine was diluted by purified nitrogen indicate that the addition reaction depends on the square of the chloride concentration, and the substitution reaction on the square root. It seems that the activation processes which appear in the above reactions with radiations must be absolutely different from those obtained with ultraviolet radiations. The values of G (the molecules having reacted for 100 ev of γ energy absorbed) were about 85,000 for benzene, 17,000 for toluene, and 43,000 for chlorobenzene. (tr-auth)

1281

FORMATION OF FREE RADICALS IN THE PROCESSES OF

PHOTOPOLYMERIZATION AND OF RADIOCHEMICAL POLYMERIZATION. S. S. Medvedev. J. chim. phys. 52, 677-88(1955) Sept. (In French)

Results are given of experiments made on the photochemical and radiochemical initiation of the polymerization of vinyl compounds. From these results, it was possible to draw certain conclusions on the nature of the formation processes of the free radicals from excited molecules and of the energy redistribution among the molecules of binary systems. (tr-auth)

1282

RADIOCHEMICAL POLYMERIZATION OF VINYL MONOMERS. Adolphe Chapiro, Michel Magat, Annette Prevot-Bernas, and Jeanne Sebban (Faculte des Sciences, Paris). J. chim. phys. 52, 689-98(1955) Sept. (In French)

In the light of recent results, a re-examination is made of certain fundamental aspects of the radiochemical polymerization of the vinyl compounds including the nature of the initiating centers, their spatial distribution, and the influence of intensity, of the solvents, of the polymer present, and of the temperature on the kinetics of the reaction. It is shown that the initiation is made by the free radicals and that all polymerization occurs as though their spatial distribution, in the stationary state, were uniform. This leads to the proportionality of the total speed to the square root of the intensity. This relationship is effectively verified by experiment in many cases and for a wide region of intensities. It is shown that the deviations from this law, which are observed under some conditions, are related to some peculiarities in propagation and termination reactions, and not to those of radiochemical initiation. (tr-auth)

1283

RETICULATION OF POLYMERS IN AQUEOUS SOLUTION BY γ RAYS. Arthur Charlesby and Peter Alexander (Atomic Energy Research Establishment, Harwell, Berks, England, Chester Beatty Research Inst., Royal Cancer Hospital, London). J. chim. phys. 52, 699-709(1955) Sept. (In French)

The effect of x and γ rays on a number of vinyl polymers in aqueous solution has been studied. Certain polymers (such as polymethacrylic acid) deteriorate at all concentrations, while others deteriorate only if they are irradiated at concentrations less than or equal to 0.5%, but they are reticulated and separate in the form of a gel if the concentration is higher. The influence of different factors on the reticulation of polyvinylpyrrolidone is described. Several theoretical interpretations have been developed in the case where intermolecular bonds result from the interaction of an activated molecule with an ordinary molecule and in the case where the molecule of the polymer is broken into two fragments with active extremities which can then produce reticulation. The experimental results are in agreement with the second mechanism designating "end linking". This case is developed in detail. The results cannot be interpreted by the mechanism of activated molecules. Certain substances added to the system play the role of protective agents, that is, they retard reticulation and the formation of the gel. This protective action takes place in two ways: by neutralization of an active center thus preventing participation in reticulation; or, by a competetive action on the free radicals formed in water before they have been able to react on the polymer. Detailed results are given in the case of thiorea which seems to react according to the competition mechanism. These results are in agreement with the established theory for this type of reaction. (tr-auth)

1284

AFTER EFFECTS IN THE POLYMERIZATION OF AQUEOUS SOLUTIONS OF METHACRYLIC ACID INITIATED BY X RAYS. M. Fox and P. Alexander (Chester Beatty Research Inst. and Royal Cancer Hosp., London). J. chim. phys. 52, 710-17(1955) Sept. (In French)

Aqueous solutions of methacrylic acid, free from O, are easily polymerized by x rays. For monomer concentrations less than 7.5%, the speed of polymerization is proportional to the monomer concentration. It then decreases to a minimum corresponding to precipitation of the polymer, that is, for a monomer concentration equal to 65%. For monomer concentrations greater than 65%, the reaction becomes more complex. In order to explain the velocity decrease in the region between 7.5% and 65%, consideration has been given to the possibility that a product capable of ending polymer chains is formed as a direct effect of the radiation. After irradiation is stopped, polymerization continues for several days at a velocity proportional to the concentration of the monomer in the polymer. It is necessary to make a distinction between this effect and the Trommsdorf effect (a phenomenon observed when the polymer is a gel.). Actually, in these experiments, the polymer is completely soluble and the viscosity of the solutions is weak. The polymer, precipitating in the course of irradiating concentrated monomer solutions, is capable of initiating polymerization of methacrylic acid even after long exposures to air. The results obtained on deterioration of polymers seem to indicate the presence of peroxide groups. (tr-auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

1285

OXIDATION OF CERIUM(III) TO CERIUM(IV) ION BY MEANS OF COBALT(III) ION. N. Hofman-Bang and I. Wulff (Technical Univ. of Denmark, Copenhagen). Acta Chem. Scand. 9, No. 7, 1230-40(1955).

Cobaltic ion, Co^{3+}, quantitatively oxidizes cerous ion, Ce^{3+}, to ceric ion, Ce^{4+}, in aqueous acid solutions. The green cobaltic carbonato complex yields the blue cobaltic aquo ion when acidified with an excess of H_2SO_4 or HNO_3. (C.W.H.)

Refer also to abstracts 1612, 1613, and 1614.

SEPARATION PROCEDURES

1286 ACCO-56

American Cyanamid Co. Atomic Energy Div. Raw Materials Lab., Winchester, Mass.

UTEX ORE STOCKPILED AT MONTICELLO. Harry D. Moulton, Jr. July 19, 1954. Decl. Sept. 23, 1955. 30p. Contract AT(49-1)-533.

A program of bench scale leaching and ion exchange testing for the recovery of uranium from liquors produced by leaching Utex ore was conducted at Monticello, Utah from July 1953 to April 1954. Optimum extractions were obtained by leaching -16 mesh ore at 50% solids for 12 hours at 85°C. with 700 pounds of H_2SO_4 per ton. With liquor produced under these conditions, 62 resin cycles were completed on 1RA-400 resin with no evidence of permanent loss in capacity. Average resin loading for this cyclic test was 61.8 grams U_3O_8 per liter of wet settled resin. Elution

was carried out with 0.9N NH_4Cl to 0.1N HCl and the uranium was precipitated from the pregnant eluate with NH_3. Build-up of sulfate occurred in the recycled eluate and concentrations as high as 300 grams per liter were attained. Contrary to expectations, instead of decreasing elution efficiency, as the sulfate concentration increased above 50 grams per liter, there was a tendency for elution efficiency to improve. (auth)

1287 AECU-3071
Dow Chemical Co. Western Div., Pittsburg, Calif.
RECENT DEVELOPMENTS IN THE PROCESSING OF URANIUM ORES AND THEIR SIGNIFICANCE IN THE EXTRACTIVE METALLURGY OF METALS. R. R. Grinstead. Sept. 12, 1955. 33p. Contract AT-30-1-GEN-236.

The two major developments in the extractive metallurgy of U, the application of the techniques of ion exchange and solvent extraction to the processing of U ores, are discussed. (J.E.D.)

1288 CC-2009
Clinton Labs., Oak Ridge, Tenn.
PREPARATION OF CARRIER FREE Zr–Cb TRACER. Progress Report on Problem Assignment 263-X61C. J. A. Marinsky and N. E. Ballou. Aug. 28, 1944. Decl. Nov. 28, 1955. 5p. (A-2870)

The cupferron–chloroform method for the preparation of carrier-free Zr and Cb activities has been shown to be quite specific. A preparation which is better than 99.8 to 99.9% pure is readily obtained and the time required is about 1.5 hours. The technique is simple and small laboratory preparations are very easily and quickly performed; good adaptability to remote control is indicated. (auth)

1289 DOW-89
Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT FOR NOVEMBER, 1952. Research Dept. R. H. Bailes. Dec. 10, 1952. Decl. Sept. 29, 1955. 69p. Contract AT-30-1-GEN-236.

The use of octyl phosphoric acid and octyl pyrophosphoric acid in a hydrocarbon diluent for the recovery of uranium and vanadium from carnotite ores and for the recovery of uranium from normal superphosphate is described. (auth)

1290 NYO-1323
Mallinckrodt Chemical Works, St. Louis.
A REPORT ON THE FILTRATION OF PITCHBLENDE DIGEST SLURRY ON AN OLIVER CONTINUOUS VACUUM ROTARY PRECOAT FILTER. Walter G. Weber. [nd] Decl. Nov. 3, 1955. 6p.

Experimental runs were made with a (3 × 1) ft Oliver drum filter using pitchblende digest slurries mixed with other plant slurries, in which the wet unwashed solids varied from 3.6 to 6.0 lb/hr. in order to determine the feasibility of its use. The filter was equipped with a precoat scraper feed mechanism, and a constant internal vacuum was applied to the entire drum throughout its revolution in order to prevent the precoat from sliding off the filter face. Average cake rates of each run varied from 3.1 to 14.5 /ft^2-hr and slurry rates from 1.1 to 4.8 gal/ft^2-hr. Depth of the doctor cut affected filtration rates; the 0.0012–0.002 in. cut average cake rate was 9.5 /ft^2-hr, while the 0.004 in. cut gave 12.3 /ft^2-hr. average, a 30% increase. Tests were done at 2.3 M.P.R. Average cake and slurry rates for the first 12 hr of operation were the same as the overall average rates. Results of washing the U from the cake were not good. The "% Water soluble x wet basis" varied from 0.6% to 6.5%. It was realized that the drag blanket method of washing used in these tests was inadequate, however, time did not permit tests of other washing methods. It is thought that the problem can be overcome with spray jets or a blanket and compression roll system for the washing. Total U contents of the filter cakes were from 0.78 to 6.5%, while moisture was from 20.6 to 42.0%. Settling of the sand in the bottom of the filter bowl presented difficulties in the fact that it caused stoppage of the filter bowl agitator, caused thick globs of sand to appear on the drum (thereby contributing to bad washing and high U in the cakes.), and also caused blockage of the bowl drain lines. The filter would have to be shielded or confined in a cell block and a remote control operating system installed for protection of the operators. A filtrate clarification system with a small solids capacity could be used since the wet solids in the filtrate were less than 0.01 /gal. (J.E.D.)

1291 NYO-1455
Harshaw Chemical Co., Cleveland.
PROGRESS REPORT FOR MARCH, 1951. J. T. Pinkston and K. S. Willson. Apr. 6, 1951. Decl. Sept. 14, 1955. 9p. Contract W-7405-Eng-276.

Extraction tests are described which were carried out on a slurry made by digesting with HNO_3 a mixture of black oxides and soda salt which was spiked with rare earths, Mo, B, and Fe. (C.H.)

1292 ORNL-1907
Oak Ridge National Lab., Tenn.
MECHANICAL FEATURES OF THE HIGGINS CONTINUOUS ION EXCHANGE COLUMN. I. R. Higgins. Oct. 25, 1955. 29p. Contract W-7405-eng-26.

The accessory equipment for the Higgins continuous ion-exchange contactor is described. Photographs of various systems used during the development work are shown. (auth)

1293 ORNL-1952
Oak Ridge National Lab., Tenn.
CHEMICAL REFINEMENT PROCEDURES IN THE ELECTROMAGNETIC SEPARATION OF ISOTOPES. Boyd Weaver. Aug. 8, 1955. 42p. Contract W-7405-eng-26.

Procedures used in the chemical refinement of electromagnetically separated isotopes of 47 elements are given in outline form. (auth)

1294 RMO-2032
International Minerals and Chemical Corp., Chicago.
LEACHED ZONE — PRELIMINARY DATA FOR ALTERNATE PROCESSES. Robert F. McCullough and Roger Bart. Sept. 13, 1954. Decl. Oct. 27, 1955. 42p. Contract AT(49-1)-545. (IMCC-2168)

Research on the recovery of U from leached zone has shown the possibilities of two alternate digestion schemes. Data presented are very preliminary and are being viewed optimistically at this time as a guide to future programming. Leached zone calcined at about 600°C was reacted for 6 hr at room temperature with sulfurous acid, produced by absorbing sulfur dioxide in an aqueous slurry, to solubilize about 80% of the uranium present. Uranium was extracted by liquid-slurry extraction using organic phosphoric acid esters. Centrifugal separation of the aqueous and organic

phases was required. Uranium may be recovered from the organic phase using conventional procedures. Approximately 80% of the sulfur oxide may be recycled from the aqueous raffinate by heating to boiling prior to liming for waste disposal in mined out areas. Acidulation of leached zone with sulfuric acid at about 300°C and atmospheric pressure solubilized about 80% of the uranium present. Leached zone was dried and classified at about 200 mesh. Minus 200 mesh material was mixed with 98% sulfuric acid, at about 40% acidulation, and heated 3 hr at 300°C. Resulting product was a porous clinker which has excellent leaching, filtering and settling characteristics. Upon slurry of the calcine with water, about 80% U_3O_8, 40% P_2O_5 and 50% Al_2O_3 were solubilized. Uranium may be extracted upon contact of this slurry with organic phosphoric acid esters and centrifugal separation of the aqueous and organic phase. Solids suspended in the aqueous raffinate exhibit fast filtering characteristics and may permit recovery of products other than uranium. Liquid-liquid and liquid-slurry extractions of uranium from the liquors or slurries produced by reaction of leached zone with sulfuric or sulfurous acids have proved successful. Organic phosphoric acid esters used for optimum uranium extraction vary for the aqueous phase composition used. (auth)

1295 RMO-2037

International Minerals and Chemical Corp., Chicago.
LEACHED ZONE — EFFECT OF ROASTING WITH SULFURIC ACID. John H. Gross, J. B. Adams, and Roger Bart. Feb. 28, 1955. Decl. Oct. 27, 1955. 30p. Contract AT(49-1)-545. (IMCC-2208)

Roasting with restricted amounts of sulfuric acid at moderate temperatures, followed by leaching with water and separation of values from the solution, is an alternate process for utilizing Florida leached zone. A study of the process as a means of recovering uranium as a single product is reported. (auth)

1296 RMO-2038

International Minerals and Chemical Corp., Chicago.
LEACHED ZONE — DIGESTION WITH SULFUROUS ACID. John H. Gross, J. B. Adams, and Roger Bart. Feb. 28, 1955. Decl. Oct. 27, 1955. 43p. Contract AT(49-1)-545. (IMCC-2209)

Detailed study of the digestion of five minus 200 mesh leached zone specimens with sulfurous acid showed the following conditions to be optimum for dissolution of uranium: calcination: 600°C for one hour. Digestion: Calcined ore suspended in water at 15% solids, saturated with SO_2 at one atmosphere pressure and ambient temperature for four hours. Minus 200 mesh fractions of 25 prospect cores were treated under these conditions to dissolve an average of 85% of the contained uranium. Average weight of uranium dissolved from the cores was 0.44 pounds U_3O_8 per ton of minus 200 mesh feed, with 90% of cores falling in the range 0.31 to 0.61 lbs. U_3O_8/ton. Assuming 95% efficiency in uranium extraction from the digestion slurry, a previous estimate of 80% recovery over the whole process is valid. Sulfur dioxide was recovered from digestion slurries by boiling at atmospheric pressure, and by aeration at 60°C. Approximately 85% of the process SO_2 was recovered by each method; with the boiling method, it was necessary to evaporate about 25% of the water content also. After recovery of sulfur dioxide, the remaining slurry required approximately 150 lb of lime per ton of minus 200 mesh feed to neutralize for waste disposal. (auth)

1297 RMO-2039

International Minerals and Chemical Corp., Chicago.
LEACHED ZONE — DIGESTION WITH MISCELLANEOUS REAGENTS. John H. Gross, J. B. Adams, and Roger Bart. Feb. 28, 1955. Decl. Oct. 27, 1955. 19p. Contract AT(49-1)-545. (IMCC-2210)

The results of a large number of experiments with miscellaneous reagents, undertaken in attempts to overcome some of the economic and chemical problems of utilizing Florida leached zone are presented. Reagents and conditions of their application were chosen on both empirical and theoretical grounds and were of many types. In aqueous digestions at atmospheric pressure and under moderate steam pressure, the following classes of reagents were surveyed: organic acids and complexing agents, neutral and acidic salts, alkalis, sulfuric acid with other reagents, acids other than sulfuric. Roasts and calcinations with acids, alkalis, and salts also were tested. In many cases, good recovery of values, high filtration rate, or other technical advantage was found. No experiment suggested a process offering reagent cost on any basis lower than the corresponding cost in digestion with sulfuric acid alone. Hence for economic reasons, all results reported here are negative. (auth)

1298 RMO-2612

Merrill Co., San Francisco.
CONTINUOUS ELECTROLYTIC TESTS. John C. Huggins, Robert A. Carlson, and Irwin F. Schwien. Feb. 17, 1954. Decl. Aug. 18, 1955. 17p. Contract AT(49-1)-540.

Results obtained from the operation of a 4-stage, continuous laboratory electrolytic unit to recover U and V from Monticello Carbonate Leach Solutions is presented. Three runs for periods of 35, 47, and 72 hrs are reported. Power consumptions were found to be on the order of 40 kwhr PTS, or 1 kwhr/lb of U_3O_8 and V_2O_5 precipitated. Recoveries of 76 to 90% of the V and 99% of the U were achieved in these tests. (auth)

1299 RMO-2617

Little (Arthur D.) Inc. Western Labs., San Francisco.
A STUDY OF THE FACTORS AFFECTING THE EFFICIENCY OF CARBONATE LEACHING. Interim Report. C. J. Hoffman, W. I. Watson, and I. F. Schwien. Mar. 31, 1955. Decl. Aug. 18, 1955. 34p. Contract AT(49-6)-923.

A study has been made to determine the factors controlling the extent of uranium extractions from a number of Colorado plateau ores by a sodium carbonate-sodium bicarbonate leach solution. Two factors identified as influencing the extractions are the fineness of the ore particle size and the maintenance of suitable oxidizing conditions in the leach solution. For the achievement of the proper particle size, the grinding procedure must also be taken into consideration. Proper selection of the mill can decrease the need for an oxidant. When necessary grinding and oxidizing conditions are provided, carbonate leaching yields uranium extractions equivalent to those reported for acid leaching. Uranium extractions as high as 99% with residues containing only 0.002% U_3O_8 have been obtained by leaching −325 mesh ore with carbonate-bicarbonate solution with potassium permanganate present. (auth)

1300 RMO-4000

Columbia Univ., New York. Mineral Beneficiation Lab. RECOVERY OF URANIUM FROM CHATTANOOGA SHALES. Progress Report [for] September 1953. N. M. Levine, W. F. Pesold, and S. Ruby. Decl. Oct. 20, 1955. 44p. Contract AT(49-1)-621.

Research and development program to be undertaken in order to establish a process for the recovery of U from Chattanooga shales is outlined. The nature of the approach and the analysis whereby the problem has been divided into its major divisions are indicated. Work done on the structure of the ore and chemical processes for its concentration is described. (J.E.D.)

1301 RMO-4002

Columbia Univ., New York. Mineral Beneficiation Lab. RECOVERY OF URANIUM FROM CHATTANOOGA SHALES. Quarterly Report [for] March 15 to June 15, 1954. M. L. Drabkin, S. Grand, J. R. Killelea, N. M. Levine, N. S. Marans, and W. F. Pesold. June 1954. Decl. Oct. 20, 1955. 78p. Contract AT(49-1)-621.

Investigation is reported of the effect of thermal treatment on the physical properties of shale and the effect that these physical properties have upon subsequent leaching. The problem of eluting Mo from ion-exchange resins may be solved by preliminary sulfide precipitation of the Mo from the leach liquor. Liquid-liquid solvent extraction shows promise as an alternative to ion-exchange. Equipment was constructed for more detailed studies of all phases of the problem. (J.E.D.)

1302 WIN-12

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

RESIN-IN-PULP PILOT PLANT TESTING OF CALURANIUM ORE. C. K. McArthur, A. W. Griffith, T. F. Izzo, R. G. Beverly, and R. L. Shimmin. Apr. 29, 1955. Decl. Sept. 19, 1955. 19p. Contract AT(49-6)-924.

Cal-Uranium ore from the Lisbon Valley District of Utah was treated in the Resin-In-Pulp Pilot Plant. The average grade of the ore as treated was 0.14% U_3O_8 with an average lime content of 9.6%. The leaching was accomplished with an average consumption of 345 lb of sulfuric acid per ton of ore. Leach contact times of 18, 14, and 10 hr yielded leach extractions of 95.5, 12.9, and 92.8%, respectively. One leach of 10 hr contact time with the addition of 5 lb MnO_2 per ton of ore resulted in an extraction of 94.8%. Some difficulty was encountered in ion exchanging this liquor. Recovery in the adsorption units was 97.8%. The eluant used was 0.9M NO_3 adjusted to a pH 1.2 with H_2SO_4. The precipitant used was MgO which gave a final product of 57.8% U_3O_8. Calculated recovery was 90.13%. (auth)

1303 WIN-18

National Lead Co., Inc., Raw Materials Development Lab., Winchester, Mass.

RESIN-IN-PULP PILOT PLANT TESTING OF ARROWHEAD ORE. C. K. McArthur, T. F. Izzo, and R. L. Shimmin. May 23, 1955. Decl. Sept. 19, 1955. 31p. Contract AT(49-6)-924.

Arrowhead ore from the Cameron district of Arizona was successfully treated in the Resin-In-Pulp Pilot Plant. Leach extraction with the use of 205 lb of H_2SO_4 and 10 lb of MnO_2 per ton of feed averaged 95.74% were made. Ion exchange recovery averaged 99% of the uranium in solution with nine banks of resin on exhaustion. The eluting solution used for the majority of the test period was 0.9M NH_4NO_3 adjusted with H_2SO_4 to a pH of 1.2. The product from nitrate elution averaged 75.7% U_3O_8. (auth)

1304

ANION-EXCHANGE STUDIES. II. THE EFFECT OF CROSS-LINKAGE ON THE ELUTION OF SEVERAL TRANSITION ELEMENTS. Rolfe H. Herber, Kayacan Tonguc, and John W. Irvine, Jr. (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 77, 5840-3(1955) Nov. 20.

A number of samples of the strongly basic anion exchange resin Dowex-1 have been studied with reference to their capacity, water content and elution behavior. Column experiments on the elution of Mn^{2+}, Co^{2+}, Cu^{2+}, and Zn^{2+} with HCl show that in each case retention of the anion complex is dependent on the cross-linkage of the exchanger. While 15 cm columns of 12% DVB Dowex-1 will effectively separate Mn^{52}–Na^{22} mixtures, 2 and 4% DVB resins will not effect this separation even in 12N HCl. A convenient instrumental arrangement for determining elution behavior of ion-exchange resins is described. (auth)

1305

INDICATORS FOR THE PAPER CHROMATOGRAPHY OF LIPIDS. Helmut K. Mangold, Beverly G. Lamp, and Hermann Schlenk (Univ. of Minnesota, Austin). J. Am. Chem. Soc. 77, 6070-2(1955) Nov. 20.

A procedure for the paper chromatographic analysis of lipids in different solvent systems is outlined. The preparation of the indicators, α-dextrin-iodine, pancreatin; iodine, and lead tetraacetate, is described. (C.W.H.)

1306

THE ELECTROLYTIC SEPARATION FROM THORIUM NITRATE OF THORIUM C(Bi^{212}) AND THORIUM B(Pb^{212}) IN CHLORIDE SOLUTION. A. D. R. Harrison, A. J. Lindsey, and R. Phillips (Sir John Cass Coll., London). Anal. Chim. Acta 13, 459-64(1955) Nov.

An electrodeposition process is described for separating thorium C(Bi^{212}) and thorium B(Pb^{212}) from solutions of $Th(NO_3)_4$ in hot 0.5N HCl. The Bi^{212} is deposited first on either Pt or Ni cathodes using a controlled potential, followed by deposition of Pb^{212}. (auth)

1307

THE SEPARATION OF GROUP IIA ELEMENTS OF THE PERIODIC TABLE BY PAPER CHROMATOGRAPHY. Robert J. Magee and James B. Headridge (Univ. of Edinburgh, England). Analyst 80, 785-8(1955) Nov.

A solvent mixture of CH_3OH–C_4H_9OH–$(CH_3)_3C_5H_2N$–6N $HC_2H_3O_2$ has been used to separate Be, Mg, Ca, Sr, and Ba chlorides. Sodium rhodizonate has been employed for the detection and estimation of Sr and Ba, and 8-hydroxyquinoline has been used for Be, Mg, and Ca. The presence of the alkali or the heavy metals caused no interference with the separation. (auth)

Refer also to abstracts 1246, 1271, 1319, 1321, 1322, 1323, and 1326.

SPECTROSCOPY

1308

MICROWAVE SPECTROSCOPY OF BIOLOGICAL SUBSTANCES. I. PARAMAGNETIC RESONANCE IN X-IRRADIATED AMINO ACIDS AND PROTEINS. Walter Gordy, William B. Ard, and Howard Shields (Duke Univ., Durham, N. C.). Proc. Natl. Acad. Sci. U. S. 41, 983-96(1955) Nov.

1309
MICROWAVE SPECTROSCOPY OF BIOLOGICAL SUBSTANCES. II. PARAMAGNETIC RESONANCE IN X-IRRADIATED CARBOXYLIC AND HYDROXY ACIDS. Walter Gordy, William B. Ard, and Howard Shields (Duke Univ., Durham, N. C.). Proc. Natl. Acad. Sci. 41, 996-1004(1955) Nov.

SYNTHESES

1310
EXAMINATION OF THE ISOTOPE EFFECT IN THE CONDENSATION OF o-BENZOYLBENZOIC ACID-CARBOXYL-C^{14} TO ANTHRAQUINONE-9-C^{14}. Gus A. Ropp (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 23, 2196-7(1955) Nov.

It is suggested that the "reverse isotope effect" observed in the condensation of o-benzoylbenzoic acid-carboxyl-C^{14} to anthraquinone-9-C^{14} (Can. J. Chem. 32, 792-801(1954) Aug.) was due to an isotopic dilution after synthesis of the acid. The theory of carbon isotope fractionation in addition processes is discussed. (C.W.H.)

1311
ON OXIDES OF TITANIUM. N. P. Bogoroditskiĭ, I. E. Zelenkova, V. G. Prokhvatilov, and I. D. Fridberg. Doklady Akad. Nauk S.S.S.R. 104, 543-5(1955) Oct. 1. (In Russian)

Experiments were set up to determine the possible synthesis of sphene-type combination for the silicotitanates $MeO-SiO_2-TiO_2$, and for the aluminotitanates of Mendeleev's second group elements $MeO-Al_2O_3-TiO_2$, where Me = Ca, Ba, Mg, Fe, Na, Ni and Zn. (R.V.J.)

Refer also to abstract 1202.

TRANSURANIC ELEMENTS AND COMPOUNDS

1312
INFRARED SPECTRUM OF PLUTONIUM HEXAFLUORIDE. N. J. Hawkins, H. C. Mattraw, and W. W. Sabol (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Chem. Phys. 23, 2191-2(1955) Nov.

The infrared spectrum of PuF_6 was measured in the range 2 to 23 μ. The molecule was assigned to O_h-symmetry. The vibrational contributions to thermodynamic properties were calculated from the fundamental vibration frequencies using the harmonic oscillator approximation. (C.W.H.)

1313
INFRARED SPECTRA OF NpF_6 AND PuF_6. John G. Malm, Bernard Weinstock, and Howard H. Claassen (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 23, 2192-3(1955) Nov.

The infrared spectra of PuF_6 and NpF_6 were measured in the range 2 to 38 μ. From the data it was concluded that these hexafluorides have the symmetry of a regular octahedron (point group O_h). (C.W.H.)

1314
ON MENDELEEV'S ONE HUNDRED ONE ELEMENT. M. B. Neiman. Priroda 44, 83-5(1955) Nov. (In Russian)

Review of methods used in obtaining element one hundred one (Mv) is given. (R.V.J.)

Refer also to abstracts 1200 and 1230.

URANIUM AND URANIUM COMPOUNDS

1315 AECD-3671
Mallinckrodt Chemical Works, St. Louis.
A BOILING POINT-COMPOSITION DIAGRAM OF THE SYSTEM URANYL NITRATE-NITRIC ACID-WATER. A. E. Ruehle. Apr. 1, 1946. Decl. with deletions Jan. 6, 1954. 7p. Contract W-14-108-Eng-8.

1316 AECD-3698
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
ASSAY OF ICPP URANIUM SOLUTIONS. S. G. Forbes. May 6, 1954. Decl. with deletions Nov. 17, 1955. 11p. Contract AT-(10-1)-205.

The method of non-destructive assay for U is being developed for application to CPP solutions. The equipment has been calibrated for product strength solutions and used for assaying some "unknowns." Additional work has also been done on solutions diluted to $\frac{1}{10}$ of product strength. Experimental data on calibration, assaying, and reproducibility tests are given. It appears feasible to obtain data with 1% standard deviation on product solutions with the present facility. (auth)

1317 CD-454
Tennessee Eastman Corp., Oak Ridge, Tenn.
PREPARATION OF A NEW MIXED HALIDE OF TUBALLOY (URANIUM). J. W. Gates, Jr., G. H. Clewett, and H. A. Young. July 20, 1944. Decl. Nov. 21, 1955. 2p.

Preliminary observations on the preparation of mixed U halides are given. The chlorination of UO_2F_2 results in a green mixed salt believed to be $UClF_3$ and $UFCl_3$. Conditions for the chlorination and precipitation are given. (D.E.B.)

1318 HW-39087
Hanford Atomic Products Operation, Richland, Wash.
SODIUM URANIUM(IV) FLUORIDE; PRECIPITATION AND REDUCTION TO METAL. W. B. Tolley. Sept. 19, 1955. 13p. Contract W-31-109-Eng-52.

The double salt $UNaF_5$ can be quantitatively precipitated from $UO_2(NO_3)_2$ solutions. Ferrous ions in the presence of F^- ions will reduce UO_2^{2+} solutions to the U^{4+} valence state. If Na^+ ions are present the salt $UNaF_5$ is precipitated instead of $UF_4 \cdot 2.5\ H_2O$. $UNaF_5$ can be completely dried in air at 110°C and is then a suitable feed for reduction to metal by the bomb technique. Using Ca as reductant the button yields from reduction averaged 96%. Iron impurity in the $UNaF_5$ salt is co-reduced and coalesced with the U metal resulting in an average Fe contamination in the metal of 0.41%. Electrolysis of the double salt dissolved in LiCl-KCl eutectic held at 500°C produced fine U needles at a current efficiency of 58%. Iron impurity was reduced to 0.0134% in the electrolytically reduced metal. (auth)

1319 JENER-38
Joint Establishment For Nuclear Energy Research, Kjeller, Norway.
THE SEPARATION OF PLUTONIUM FROM URANIUM AND FISSION PRODUCTS WITH ION EXCHANGE COLUMNS. T. Sikkeland. 4p.

Tetravalent Pu is quantitatively adsorbed from a U solution by passing this through a column with a cation exchange resin. The U and most of the fission products are eluted with 2M HCl and Pu and the remaining fission

products with 5M HCl. The final separation of Pu from the fission products is obtained with an anion exchange column. The recovery of radiochemically pure Pu by the whole procedure is 99%. (auth)

1320 NYO-3918

Tufts Coll., Medford, Mass.

THE DISSOCIATION PRESSURE AND THE NATURE OF URANIUM HYDRIDE AND THE PREPARATION OF TRANSITION METAL HYDRIDES, PART I: PAPER 1. DENSITY OF PARTIALLY DEHYDROGENATED SAMPLES OF UH_3. Edward J. Goon; PAPER 2. A REVIEW OF THE STATISTICAL MECHANICAL APPROACH TO METAL–HYDROGEN SYSTEMS. George G. Libowitz; PAPER 3. REFERENCES TO THE PREPARATION OF HYDRIDES FROM ORGANOMETALLIC COMPOUNDS. Thomas R. P. Gibb, Jr. Nov. 17, 1954. 16p. Progress Report on the Preparation and Properties of Metal Hydrogen Systems. Contract AT(30-1)-355.

Samples of $UH_{2.78}$ and $UH_{2.86}$ were heated at temperatures up to 250°C for varying periods, and the density, H_2 content, and diffraction patterns measured. The literature on statistical mechanical derivations of pressure-composition isotherms for metal–hydrogen systems is surveyed. The preparation of hydrides from organometallic compounds is discussed. (C.W.H.)

1321 RMO-2616

Little (Arthur D.) Inc. Western Labs., San Francisco.

DEVELOPMENT OF A CHAR-IN-PULP PROCESS FOR THE RECOVERY OF URANIUM. Interim Report. Paul Noble, Jr., I. M. Whittemore, R. A. Carlson, and W. I. Watson. [Oct. 1954]. Decl. Aug. 18, 1955. 97p. Contract AT(49-6)-923.

A preliminary investigation of a process for the recovery of U values from dilute acid solutions and slurries was carried out. The process is based on the development of an adsorbent active for U through suitable treatment of an activated solid surface with a chelating agent capable of favorable competition with the complexing ions in solution. With dioctyl pyrophosphoric acid adsorbed on a hard activated charcoal, recoveries by adsorption of 97 to 99% of the U from dilute sulfuric acid solutions were obtained. Application to leach solutions and ore pulps are reported. (auth)

1322 WIN-3

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

ACID AND CARBONATE LEACHING OF NORTH JACKPILE ORE. J. Q. Jones, J. B. Larson, James T. Lynch, E. S. Porter, G. Trueman, and H. I. Viklund. Feb. 21, 1955. Decl. Sept. 19, 1955. 21p. Contract AT(49-6)-924.

Laboratory investigation of a composited drill core sample from the North Jackpile ore body near Grants, New Mexico, revealed that the ore is readily amenable to acid leaching and ion exchange. Good settling rates were obtained on neutral and acid leached pulps. An oxidant was beneficial to leaching. Carbonate leaching was also effective either with a chemical oxidant or following a preliminary roast. Filtration of carbonate leached pulps was difficult. (auth)

1323 WIN-5

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

RESIN-IN-PULP PILOT PLANT TESTING OF EDGEMONT ORE. R. F. Hollis, C. K. McArthur, T. F. Izzo, A. W. Griffith, and R. L. Shimmin. Jan. 11, 1955. Decl. Sept. 19, 1955. 23p. Contract AT(49-6)-924.

Ore from the Edgemont District of South Dakota was treated in the Resin-In-Pulp Pilot Plant. Satisfactory leaching was accomplished with about 40 lb of H_2SO_4 per ton of ore. Leach contact times of 10, 8, and 6 hr all yielded extractions of 97% of the U. No difficulty was encountered in ion-exchanging this liquor. Recovery in the adsorption units was over 99%. A solution 0.9M NO_3 with the pH adjusted to 1.2 with H_2SO_4 was employed as the eluant. Pregnant eluate was precipitated with MgO resulting in a product that averaged 67.40% U_3O_8. Calculated recovery was 95.7%. (auth)

1324 AEC-tr-2354

ON THE OXIDATION OF METALLIC URANIUM. Jean Loriers. Translated by I. A. Warheit from Compt. rend. 234, 91-3(1952). 3p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 6-1435.

1325

SIMPLIFIED HIGH TEMPERATURE SAMPLING AND USE OF pH FOR SOLUBILITY DETERMINATIONS. SYSTEM URANIUM TRIOXIDE–SULFURIC ACID–WATER. William L. Marshall (Oak Ridge National Lab., Tenn.). Anal. Chem. 27, 1923-7(1955) Dec.

The solubility of UO_3 in aqueous H_2SO_4 at elevated temperatures, 150 to 290°C., has been determined by directly sampling a solution equilibrated with solid uranium trioxide hydrate at the respective temperatures and comparing the pH of the isolated sample at 25°C with control pH data. Isotherms of the solubility of uranium trioxide hydrate in aqueous sulfuric acid have been obtained from 1.0 to 0.00023 molal acid. In the apparatus designed for solubility determinations particular solutions are sampled with rapidity and ease. The solution sample is delivered at room temperature, but removed from the saturated solution at the equilibration temperature. This sampling method is reproducible and apparently reliable. The control pH data of uranium trioxide–sulfuric acid–water solutions at 25.00 ± 0.04°C have been determined to a precision within ± 0.004 pH unit from 0.024 to 0.00024 molal H_2SO_4. These data have been obtained by the use of a vibrating reed electrometer and accessory equipment. (auth)

1326

EXTRACTION OF URANYL NITRATE WITH ETHER FROM AQUEOUS SOLUTIONS IN A SPRAY COLUMN. F. Oltra Oltra, A. Pérez Luña, and L. Gutiérrez Jodra. Anales real soc. españ. fís. y quim. (Madrid), Ser. B 51, 581-91 (1955) Sept.-Oct. (In Spanish)

The extraction of uranyl nitrate by diethylether from aqueous solutions in a spray column has been studied. The direction of extraction is opposite that one used before. The variables studied are the rates of flow of the phases and continuous phase. The transfer coefficients have been calculated and correlations of these constants are given. A comparison with previous results and a discussion of the values obtained are included. (auth)

Refer also to abstracts 1230, 1239, 1247, 1249, 1250, 1286, 1294, 1295, 1296, 1298, and 1299.

WASTE DISPOSAL

1327 AECU-3115

California. Univ., Berkeley. Sanitary Engineering Research Lab.

UNDERGROUND MOVEMENT OF RADIOACTIVE WASTES. Progress Report No. 1 covering period July 1, 1954 to June 30, 1955. Warren J. Kaufman, Richard G. Orcutt, and Gerhard Klein. Aug. 1, 1955. 92p. Contract AT-11-1-GEN-10.

A preliminary investigation was made of several physical and chemical factors influencing the feasibility of high-level radioactive waste disposal by injection into isolated geological formations. The report includes a review of the injection disposal practices of the petroleum and chemical industries and considers the problems likely to be encountered in using similar techniques for the disposal of fission product wastes of the nuclear energy industry. Laboratory model and field studies were made to determine the influence of hydraulic parameters on velocity variations during the flow of liquids through porous media. The contribution of longitudinal mixing in laminar flow to the development of concentration fronts has been considered. It was observed that even in homogeneous isotropic media, portions of the injected waste may travel at velocities exceeding six times the average. A Hele-Shaw parallel plate viscous flow model was employed to investigate density displacements resulting from the injection of a liquid differing in density from the formation water. Column studies of clays and a typical oil sand have shown that exchange reactions may retard the advance of radiostrontium concentration fronts to as much as one fortieth of that of the liquid fronts. Ion exchange may thus make a significant contribution to the waste storage capacity of connate formations. (auth)

1328 ORNL-1966

Oak Ridge National Lab., Tenn.

THE REMOVAL OF FISSION PRODUCTS FROM AN ACID ALUMINUM NITRATE SOLUTION BY CO-PRECIPITATION METHODS. Herman L. Krieger, Bernd Kahn, and Conrad P. Straub. Oct. 20, 1955. 19p. Contract W-7405-eng-26.

The removal of the major long-lived fission products by co-precipitation from an acid aluminum nitrate solution has been studied. Of the methods investigated the most efficient and economical treatment was found to be the co-precipitation of Ru and Cs with copper ferrocyanide; of Sr with barium sulfate; of Zr and Nb with zirconyl phosphate; and of the rare earths and Y with cerium oxalate. Approximately 95% of the added tracers and carriers were removed from solution in a precipitate of about 50 g/l at a cost of 1.5 cents per liter. (auth)

1329 UCLA-344

California. Univ., Los Angeles. Atomic Energy Project.

RADIOARGON EFFLUENT FROM THE STACK OF THE MEDICAL RESEARCH REACTOR. M. A. Greenfield, A. Norman, and D. P. Gamble. Sept. 26, 1955. 12p. Contract AT-04-1-GEN-12.

The maximum concentration of radioargon in the effluent from the stack of the Medical Research Reactor will give a γ ray dose rate, measured at the stack, of 1.9 mr/year. This is about 1% of the dose rate due to the natural background radiation. (auth)

1330

CONCENTRATING FISSION PRODUCTS. L. P. Hatch and W. H. Regan, Jr. (Brookhaven National Lab., Upton, New York). Nucleonics 13, No. 12, 27-9(1955) Dec.

The techniques of removal of nitric acid from unalloyed U fuel wastes, of $Al(NO_3)_3$ from the wastes from U–Al alloy fuels, and of Zr fluorides from Zr-alloyed fuel wastes are discussed. The design of a ball mill-kiln for concentrating fission products in Al_2O_3 produced from $Al(NO_3)_3$ content of waste is given. Pretreatment methods which can be used before the ultimate disposal of fission products in montmorillonite clay are discussed. (B.J.H.)

ENGINEERING

1331 AECU-3076

Sandia Corp., Albuquerque, N. Mex.

PERFORMANCE OF A TABLE STRUCTURE OF AN ELECTROMAGNETIC VIBRATION EXCITER. A. J. Beck. Mar. 1955. 21p. Contract AT-(29-1)-789.

An ideal vibration table is one in which all points vibrate in a pure linear sinusoidal motion, at exactly the same phase and amplitude. Commercial electromagnetic vibration exciters of the medium to high force capacity are supplied for frequencies up to 500 cps and up to 2000 cps. Experimental vibration surveys of a typical table structure indicated that this equipment will not satisfy the ideal requirements given above due to two difficulties. The vibratory forces produced by the electromagnetic exciter contain measurable second, third, and fifth harmonics. In addition, the table structure has a relatively low-frequency mechanical resonance which is either excited by the fundamental, or one of the harmonics of the exciting force to produce an undesirable condition where all points on the table do not vibrate at exactly the same phase and amplitude at several critical frequencies within the operating range. (auth)

1332 LRL-101

California Research and Development Co. Livermore Research Lab., Livermore, Calif.

COST ESTIMATING PROCEDURE FOR EVALUATION WORK. D. W. Altwein, E. D. Kane, and N. B. Shumate. Feb. 1954. 20p. Contract AT(11-1)-74.

This report presents a résumé of the procedure for estimating plant construction costs used by the California Research and Development Company in its Reactor Design Evaluation Program. Developed for use in comparative evaluations of alternative processes, it is a simplified and condensed version of procedures used for construction cost estimates. (auth)

1333 NP-5830

Denver. Univ. Denver Research Inst.

DEVELOPMENT OF "CHAIN TYPE" POLYPHENYL COMPOUNDS FOR USE AS HIGH TEMPERATURE LUBRICANTS AND HYDRAULIC FLUIDS. Quarterly Progress Report No. 2 [for] July 15, 1955 to October 15, 1955. John A. Krimmel and John R. Hobaugh. Oct. 24, 1955. 28p. Project No. 5-(7-7340). DRI Project No. 116. Contract AF33(616)-2939.

A code for the classification of the chemical and physical properties of chain-type polyphenyl compounds on IBM cards has been developed. Isomeric hexylbiphenyls and heptylbiphenyls of undetermined structure have been synthesized. (auth)

1334
COLLECTED RESEARCH PAPERS FOR SPRING 1954. F. J. Van Antwerpen, Ed. Chem. Eng. Progr. 50, Symposium Ser. No. 10, 1954. 142p.

Pressure-drop data were obtained for the cocurrent turbulent-turbulent flow of air and water-clay suspensions in horizontal pipes. The concept of additivity of resistances for interphase transfer of solute between two liquids has been studied. The use of porous materials as a means of separating azeotropes in the vapor phase was also investigated. The equation for diffusion of a single species through an inert gas was solved for the case of gas flowing through a tubular reactor with a depletion process occurring at the wall. The loading and flooding in packed irrigated towers, and the relation of these phenomena to pressure drop are discussed. The effect of total pressure on the gas-film absorption coefficient has been studied. A correlation is presented of the variables affecting mass transfer between immiscible liquids in continuous flow in an agitated chamber. The momentum transfer in an air jet issuing into a duct is discussed. The kinetics of the hydrogenation of propylene over a palladized alumina catalyst were studied as a function of temperature, composition, and flow rate through the catalyst bed. A theoretical relation is derived for the rate of evaporation of a solid material which forms the base of a flat duct through which air is moving in streamline flow. Phase-equilibria measurements were made on the $HCl-C_2H_6$ system in the temperature range −60 to −30°C. The integral isobaric heat of vaporization and other thermodynamic properties have been determined for the $CH_3OH-C_4H_6$ system at pressures averaging 735 mm. (C.W.H.)

HEAT TRANSFER AND FLUID FLOW

1335 K-1243
Oak Ridge Gaseous Diffusion Plant, Tenn.
REACTION RATES OF NON-ISOTHERMAL PROCESSES. 1. A SIMPLE MODEL FOR FIRST ORDER KINETICS. W. Davis, Jr. Nov. 25, 1955. 27p. Contract W-7405-eng-26.

A first order, non-isothermal model of solid phase reaction kinetics has been theoretically formulated on the basis that the heat of the chemical reaction causes a rise in the temperature of the reacting materials. Systems have been examined under adiabatic conditions and also under conditions of various amounts of conductive, convective, and radiative heat losses. In contrast to the isothermal system, reaction rates in a first order, non-isothermal system are found to depend upon the amount of reaction controlling species originally present, as well as upon the heat capacity, and, therefore, size and materials of construction, of the reactor. Other important variables, in addition to heat transfer coefficients, are heat of reaction and activation energy. (auth)

1336 KAPL-531
Knolls Atomic Power Lab., Schenectady, N. Y.
HEAT TRANSFER I. Nuclear Engineering Course 1948–1949. H. A. Johnson. Feb. 24, 1949. Decl. Nov.22, 1955. 18p. (MEMO-NEC-6)

This report is a reprint of a lecture dated Jan. 29, 1948 by R. C. Martinelli.

Heat generation in reactors is discussed. Coolant criteria in the reactors are listed, and the heat transfer limitations on pile output are given. Heat conduction equations are discussed and are applied to specific problems of heat transfer in reactors. The flux plotting method for solving conduction problems is considered. The importance of a good thermal contact is also discussed. (B.J.H.)

1337 KAPL-532
Knolls Atomic Power Lab., Schenectady, N. Y.
HEAT TRANSFER II. Nuclear Engineering Course 1948–1949. H. A. Johnson. Feb. 24, 1949. Decl. Nov. 22, 1955. 18p. (MEMO-NEC-7)

This report is a reprint of a lecture dated Feb. 5, 1948 by R. C. Martinelli.

The general theory of heat transfer due to fluid flow is discussed. The particular example of a fuel rod in a pile cooled by He and by Na is considered, including cases where flow area is not circular. (B.J.H.)

1338 AERE-Lib/Trans-579
ON THE THEORY OF HEAT EXCHANGE ON BOILING IN PIPES. L. S. Sterman. Translated by J. B. Sykes from Zhur. Tekh. Fiz. 24, 250-7(1954). 10p.

A system of differential equations is given which describe, in hydraulic form, heat exchange on boiling in pipes. A general functional relation is established between criteria of similarity. A critical analysis is given of certain relations and criteria previously established by other investigators. (auth)

1339
EFFECTS OF SURFACE TENSION AND VISCOSITY IN CONDITIONS OF HEAT EXCHANGE AT BOILING POINT OF WATER. E. K. Averin and G. N. Kruzhilin. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 10, 131-7(1955) Oct. (In Russian)

1340
TURBULENT BOUNDARY LAYER IN NONCOMPRESSIBLE LIQUID ON A POROUS DIAPHRAGM. L. E. Kalikhman. Zhur. Tekh. Phys. 25, 1957-64(1955) Nov. (In Russian)

Simple theoretical formulas for calculation of the diaphragm resistance and heat exchange are given. (R.V.J.)

Refer also to abstract 1150.

WASTE DISPOSAL

Refer to abstract 1327.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

1341 NYO-4632
Massachusetts Inst. of Tech., Cambridge.
STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES. Quarterly Progress Report for the Period Ending October 1, 1955. F. H. Norton and W. D. Kingery. Oct. 1, 1955. 7p. Contract AT(30-1)-1192.

The surface tension of liquid germanium dioxide increases from 250 dynes/cm at 1150°C to 263 dynes/cm at 1400°C. The temperature coefficient of surface tension for pure nickel is negative. Studies of surface tension, wettability, and sintering are continuing. (auth)

1342 NYO-6451
Massachusetts Inst. of Tech., Cambridge.
THE MEASUREMENT OF THERMAL CONDUCTIVITY OF

REFRACTORY MATERIALS. Quarterly Progress Report for the Period Ending October 1, 1955. W. D. Kingery and F. H. Norton. Oct. 1, 1955. 16p. Contract AT(30-1)-960.

Data for thermal conductivity in the system $MgO-SiO_2$, $Al_2O_3-ZrO_2$, and for polycrystalline TiO_2 are reported. Infrared absorption data in the temperature range from room temperature to 1200°C are reported for fused silica and sapphire. An expression for the radiant heat transfer in opaque powders has been derived. (auth)

1343

INVESTIGATION OF EQUILIBRIA IN ZrO_2-C AT HIGH TEMPERATURES. V. S. Kutsev, B. F. Ormont, and V. A. Epel'baum. (Karpov Physico-Chemical Inst.) Doklady Akad. Nauk S.S.S.R. 104, 567-70(1955) Oct. 1. (In Russian)

Corrective calculations for ZrO_2-C equilibrium were made. Experiments established that, contrary to the existing data, the reduction of ZrO_2 by carbon does not form ZrC carbide but the carbidoxyl of composition ZrC_xO_y. In equilibrium at 1800 to 2000°K and 150 to 1000 mm. pressure ZrO_2-C forms a carbidoxyl of composition $ZrC_{0.71}O_{0.08}$. (R.V.J.)

1344

HOT PRESSED BORON NITRIDE. K. M. Taylor (The Carborundum Co., Niagara Falls, N. Y.). Ind. Eng. Chem. 47, 2506-9(1955) Dec.

The properties of a refractory made by hot pressing boron nitride powder in graphite dies at relatively high temperatures and under moderate pressure are described. Several commercial applications are suggested. (C.W.H.)

1345

SPECIAL REFRACTORIES FOR USE ABOVE 1700°C. O. J. Whittemore, Jr. (Norton Co., Worcester, Mass.). Ind. Eng. Chem. 47, 2510-12(1955) Dec.

The properties, high-temperature applications, and limitations of alumina (Al_2O_3), magnesia (MgO), zirconia (ZrO_2), calcium oxide (CaO), magnesium aluminate ($MgO \cdot Al_2O_3$), beryllia (BeO), thoria (ThO_2), and uranium dioxide (UO_2) are discussed. (C.W.H.)

1346

NEW USES FOR SUPERREFRACTORIES IN THE CHEMICAL INDUSTRY. H. L. Read, F. C. Roe, H. S. Schroeder, and W. L. Wroten (The Carborundum Co., Perth Amboy, N. J.). Ind. Eng. Chem. 47, 2513-16(1955) Dec.

Industrial applications of the superrefractories, silicon carbide, alumina, and mullite, are reported. These materials exhibit resistance to thermal shock and spalling, high resistance to abrasion, and good resistance to acid corrosion. (C.W.H.)

Refer also to abstract 1268.

CORROSION

1347 AF-TR-6519(Pt.IV)

Ohio State Univ. Research Foundation, Columbus.

MATERIALS FOR HANDLING FUMING NITRIC ACID AND PROPERTIES OF FUMING NITRIC ACID WITH REFERENCE TO ITS THERMAL STABILITY. Conducted from April 1953 to March 1954. Mars G. Fontana. May 1955. 139p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: CORROSION AND CORROSION PREVENTION. Contract AF 33(038)-10381.

Polarization studies were made to study the effect of temperature on galvanic couple systems. Results used to determine the maximum limiting corrosion rates of the aluminum-stainless steel couple system, show good correlation with observed values. RC-70 and Ti-150-A titanium show only a slight decrease in fatigue strength when tested in WFNA. Erosion-corrosion studies show that the corrosion rate increases on aluminum and decreases on stainless steel when exposed to flowing solutions. The effect is more pronounced with increasing rate of acid flow. Results of the "guinea pig" testing program, long time tests in closed containers, are summarized in this report. A series of measurements of the rate of decomposition and the equilibrium decomposition pressure of pure nitric acid were carried out in glass tubes. The relation between the ratio of vapor volume to the total volume of the sample, the temperature, and the decomposition pressure was established over the temperature range from 76 to 125°C and was extended by extrapolation to room temperature. The initial results of a similar study of the nitric acid–water system are reported. The results, when compared with those of pure nitric acid, show that, for the same V^G/V and temperature, the addition of water in small amounts to the pure acid materially reduces the decomposition pressure and rate of decomposition. The apparatus and experimental techniques used are described in detail. (auth)

1348 AEC-tr-2344

THE RELATIONSHIP OF THE REASONS FOR CAUSES OF CORROSION IN ALUMINUM FROM ITS PHYSICAL AND CHEMICAL NATURE. E. Maas. Translated by D. E. Cardamone from Korrosion u. Metallschutz 3, 25-30(1927). 10p.

The effects of surface properties and annealing temperature on Al corrosion and the effect of impurity content on the dissolution of Al in acidic and basic solutions were discussed. (C.W.H.)

1349

THE CORROSION BEHAVIOR OF ALUMINUM. Hugh P. Godard. Corrosion 11, 542t-52t(1955) Dec.

The practical corrosion behavior of aluminum is reviewed. Included is a discussion of the following topics: the relative nature of corrosion resistance, resistance criteria, factors influencing corrosion rates, common corrosion problems, how to choose an alloy; and galvanic, deposition, crevice and pitting corrosion. Specific information is given on corrosion in six major environments. Other topics considered include corrosion of brazed and welded joints, atmospheric performance of anodized aluminum and preventive measures. Twenty-nine references are appended for persons interested in further study. (auth)

GEOLOGY AND MINERALOGY

1350 RME-58(Pt.I)

Grand Junction Operations Office, AEC, Colo.

DRILLING AT THE SUN FLOWER AND SNOW FLAKE CLAIMS, LUCKY STRIKE AND PETERINO CLAIMS, AND YELLOW CIRCLE CLAIM GROUP, SAN JUAN COUNTY, UTAH. PART I. Chester E. Farrow, Jr., Richard A. Teichman, Jr., Robert C. Dickinson, and James K. Hilleary. Jan. 5, 1955. 24p. Contracts AT(30-1)-1261; AT(05-1)-225; and AT(30-1)-1185.

The Sun Flower and Snow Flake claims, the Lucky Strike and Peterino claims, and the Yellow Circle group, all

situated in San Juan County, Utah. were drilled. The deposits occur in the Salt Wash member of the Morrison formation, and are of the carnotite-vanoxite type. In the Yellow Circle area, preliminary subsurface maps were helpful in carrying out the drilling program. The subsurface studies made during exploration and development drilling in the Yellow Circle district have proven useful in delineating favorable areas. (auth)

1351 RME-80(Pt.I)

Grand Junction Operations Office, AEC, Colo.

WAGON DRILLING IN THE SKULL CREEK AREA, MOFFAT COUNTY, COLORADO. William D. McDougald. Apr. 1955. 15p.

Wagon drilling projects, totaling 3,252 ft, were completed in secs. 33 and 35, T. 4 N., R. 101 W., Moffat Co., Colo. The purpose of the drilling was to evaluate the potentialities of a sandstone facies of the Curtis formation by determining the extent of partially developed orebodies, and to establish possible ore guides and controls. The only significant uranium deposits known in the Skull Creek area are restricted to a lower sandstone facies of the Curtis formation. The Morrison and Shinarump formations, two of the main uranium host rocks of the Colorado Plateau province, are not economically important in this area to date. Carnotite occurs in lenticular bodies associated with carbonaceous material. Joint systems appear to excerise some control over the localization of secondary minerals in one area. (auth)

1352 RME-1044

Division of Raw Materials. Denner Exploration Branch, AEC.

RECONNAISSANCE FOR URANIUM IN THE SOUTH CENTRAL PART OF COLORADO. L. J. Brown and R. C. Malan. June 1, 1954. 17p.

The Sangre de Cristo Mountains of south central Colorado, the San Luis Valley adjoining them on the west, and the belt of upturned sediments adjoining them on the east constitute the principal regions covered. Some reconnaissance was also made in and near the Canon City embayment-partly in conjunction with an air-borne scintillometer survey—and between Colorado Springs and the Cripple Creek—Victor mining district. Rocks of pre-Cambrian to Tertiary ages were investigated. Several pegmatite dikes in the pre-Cambrian metamorphic complex on the western slope of the Sangre de Cristo Mountains show local abnormal radioactivity. A few small shipments of low-grade uranium ore have been made from these pegmatites. In the LaVeta Pass area, the mineralized zone extends for about 25 miles in undifferentiated Permian-Pennsylvanian red sandstone. The mineralized outcrops are characterized by carnotite and secondary minerals of vanadium and copper. Only one deposit of ore-grade, at the City Slicker mine, is presently known. Flat-lying Cretaceous and Jurassic sediments were examined in the Canon City embayment area with only the Dakota sandstone showing anomalous radioactivity. Quaternary fill covers the floor of the San Luis Valley making the discovery of uranium minerals unlikely. (auth)

1353 RME-2023

Division of Raw Materials. Salt Lake Exploration Branch, AEC.

AIRBORNE RECONNAISSANCE PROJECT, DRIPPING SPRING QUARTZITE, ARIZONA. D. N. Magleby and W. E. Mead. Jan. 1955. 23p.

A low-level airborne radiometric survey of the pre-Cambrian Dripping Spring quartzite was undertaken in the mountainous region lying roughly 100 miles east of Phoenix, Arizona. Twenty new radioactive anomalies were located. Eight of these are believed to contain material of ore grade, and several of the others have possibilities as large low-grade uraniferous deposits. Although reconnaissance flights were made over several formations, the survey was concentrated mainly in the Dripping Spring quartzite. (auth)

1354 RME-2024

Division of Raw Materials. Salt Lake Exploration Branch, AEC.

AIRBORNE RECONNAISSANCE PROJECT, GREEN RIVER BASIN, WYOMING. Interim Report. D. N. Magleby and R. J. Meehan. Jan. 1955. 7p.

A part of the Green River Basin airborne reconnaissance project was completed during the months from July through October 1954. No uranium mineralization of commercial value was found. (auth)

1355 RME-2032(Pt.1)

Division of Raw Materials. Salt Lake Exploration Branch, AEC.

URANIUM OCCURRENCE AT THE MOONLIGHT MINE, HUMBOLDT COUNTY, NEVADA. Byron J. Sharp. Mar. 1955. 15p.

Uranium mineralization in the Moonlight mine occurs along a north-south trending fault which displaces a sequence of volcanic rocks. A Jurassic(?) intrusive (granodiorite) crops out to the north of the mine and is also exposed in the lower workings. The volcanic sequence was presumably extruded upon an old erosion surface of the granodiorite. The main uranium minerals are autunite, torbernite, and possibly gummite and uraninite. Gangue minerals include iron oxides, pyrite, quartz, fluorite and clays. The grade of the ore is marginal although mineralization is continuous throughout the shaft to a depth of 270 ft. The Moonlight structure is one of several similar faults which parallel the mountain front. No appreciably radioactive material has been found along the other faults to date. (auth)

1356 RME-3105

Iowa State Coll., Ames. Statistical Lab.

SOME STATISTICAL PROBLEMS OF URANIUM EXPLORATION. Final Technical Report. M. R. Mickey, Jr. and H. W. Jespersen, Jr. Sept. 8, 1954. 78p. Contract AT(30-1)-1377.

The results of this study of the application of statistical methods and concepts to problems of exploration for uranium ore are presented. The body of the report is separated into three sections. The first of these provides a general discussion of exploration applications of statistics. The second is a survey of the work that has been done. The third section presents, in the form of appendices, a set of five technical papers. These deal with the derivation of the results on pattern drilling, the utilization of reconnaissance information concerning the amount of ore showing on an outcrop, a contribution to the statistical methodology of treating orientation data, and, finally, two topics of theoretical statistics. (auth)

1357 RME-3112

Bureau of Mines and Geological Survey.

KNOB CREEK MONAZITE PLACER, CLEVELAND

COUNTY, NORTH CAROLINA. R. F. Griffith and W. C. Overstreet. Jan. 1953. 31p.

The results of drilling indicate that in the area drilled there are 3,330,000 yd^3 of minable alluvium containing 2,780 tons of monazite, 11,700 tons of garnet, 7,700 tons of ilmenite, and 330 tons of zircon. The area that could be worked as a continuous deposit can be extended downstream from the area drilled to include an additional 64 acres. If further exploration proves the tenor of this addition to be comparable to that of the area drilled, the total volume of the deposit would be increased to over 5,000,000 yd^3 and the indicated reserves of monazite to 4,375 tons. The monazite tenor of the lower 30% of the section is nearly 4 to 1 that of the overlying sediments. However, the indicated average of 0.9 lbs of monazite per yd^3 contained in the upper 70% of the deposit indicates that it would be more economical to mine the entire average depth of 18.5 ft than to employ stripping methods. An income from other heavy minerals and the sand and gravel contained in this deposit can be expected to defray a part of the costs of mining. (auth)

1358 RME-3119

Columbia Univ., New York.
INTERPRETATION AND EVALUATION OF THE URANIUM OCCURRENCES NEAR GOODSPRINGS, NEVADA. Final Report. Paul B. Barton, Jr. and Charles H. Behre, Jr. Dec. 31, 1954. 108p. Contract AT(30-1)-1550.

The uranium occurrences near Goodsprings, Clark Co., Nevada, are divided into two distinct types which differ from each other in geographic distribution, localization of mineralization, mineralogy and origin. None of the known deposits is of present commercial significance and therefore this study emphasizes the genetic rather than the economic aspects. East of Goodsprings in an area at least 4 by 16 miles and in a single propsect 2 miles north of Goodsprings carnotite is found as thin films and specks on fractures in late Paleozoic sedimentary rocks and in Tertiary and later tuff and gravel. The carnotite was probably deposited above the water table from groundwater that derived uranium and vanadium from a tuff which formerly covered the region. The tuff remnants carry about 10 ppm uranium, or about 2½ times that of the average granite. Structural control of groundwater circulation appears to be the principal feature in the localization of this mineralization. Many of the base metal mines of the Goodsprings district exhibit anomalous radioactivity attributable to uranium and its decay products. Most commonly the radioactivity is localized by limonite, hydrozincite or chrysocolla. Secondary uranium minerals are found in 3 mines, but no primary uranium minerals have been identified. The radioactivity from these materials which are free from visible uranium minerals is attributed to the adsorption of uranium from solution by colloidal materials during the oxidation of the primary sulfide ore bodies. Laboratory studies show that the uranyl carbonate, uranyl hydroxide and uranyl ions are adsorbed by colloidal hydrous ferric oxide or basic zinc carbonate. Upon crystallization of the adsorbent, the uranium either is returned to solution or forms discrete uranium minerals. The source of the uranium is believed to have been a primary uranium mineral (presumably pitchblende) which was associated more closely with the primary copper and iron sulfides than with those of zinc and lead. The volcanic rocks which once covered much of the area possibly could have contributed small amounts of uranium to the oxidizing base metal ores, but this effect was probably of minor importance. No geographic limits of uranium mineralization could be established, but there is a tendency for the more western mines to have the better uranium showings. (auth)

1359

GEOLOGY OF THE GATEWAY QUADRANGLE, COLORADO. GEOLOGIC QUADRANGEL MAP GQ-55. Fred W. Cater, Jr. Washington, U. S. Geological Survey, 1955.

The geologic map of the Gateway Quadrangle is part of a comprehensive study of carnotite deposits. The study, covering the principal carnotite producing area in southwestern Colo., included detached examination of mines and geologic mapping of eighteen 7½ minute quadrangles. Descriptions of geologic formations and general descriptions of regional structural setting, geologic history, and ore deposits are given. (J.E.D.)

1360

GEOLOGY OF THE ATKINSON CREEK QUADRANGLE, COLORADO. GEOLOGIC QUADRANGLE MAP GQ-57. E. J. McKay. Washington, U. S. Geological Survey, 1955.

The geology of the Atkinson Creek Quadrangle, Colorado, was mapped as a part of a comprehensive study of carnotite deposits. The study, covering the principal carnotite-producing area in southwestern Colo., included detailed examination of mines and geologic mapping of eighteen 7½-minute quadrangles of which the Atkinson Creek Quadrangle is one. Descriptions of geologic formations and general descriptions of regional structional setting, geologic history and ore deposits are given. (J.E.D.)

1361

CRITERIA FOR OUTLINING AREAS FAVORABLE FOR URANIUM DEPOSITS IN PARTS OF COLORADO AND UTAH. E. J. McKay. U. S. Geol. Survey Bull. 1009-J, 1955. 20p. plus 1 illus. $0.55 (GPO)

Most of the uranium deposits in the Uravan and Gateway mining districts are in the persistent upper sandstone stratum of the Salt Wash member of the Morrison formation. Areas in which this stratum is predominantly lenticular have been differentiated from areas in which the stratum is predominantly nonlenticular. The most favorable ground for uranium deposits is in areas of lenticular sandstone where the stratum is underlain by continuous altered greenish-gray mudstone. Ore is localized in scour-and-fill sandstone beds within favorable areas of lenticular sandstone. Discrete regional patterns of ore deposits and altered mudstone are associated with Tertiary structures; where these structures and favorable host rocks occur in juxtaposition, regional controls appear to have localized ore deposits. (auth)

1362

RADIOACTIVITY INVESTIGATIONS AT EAR MOUNTAIN, SEWARD PENINSULA, ALASKA, 1945. P. L. Killeen and R. J. Ordway. U. S. Geol. Survey Bull. 1024-C, 1955. 39p. plus 2 illus. $0.40 (GPO)

The presence of uranium has been determined chemically in a lode deposit and in heavy-mineral concentrates from gravels of streams that head in Ear Mountain. Thorium is probably also present because the amount of equivalent uranium, as determined by beta and gamma counts, is higher than the amount of chemically determined uranium. The probable thorium content of the

radioactive minerals in the placer concentrates is 3 to 10 times that of the uranium content, but in the lode the uranium content is about 2 to 3 times that of the possible thorium content. The uranium and thorium in the placer concentrates is probably in monazite and perhaps also in zircon; both are accessory constituents of the granite. The occurrence of two radioactive minerals in the area, which differ in the ratio of uranium to thorium and in time of formation, suggests that thorium was largely concentrated in the early accessory minerals of the granite and uranium in the final products of differentiation. The low radioactive-minerals content of the gravels and the low tonnage of lode material indicate that the Ear Mountain area does not warrant further investigation as a source of radioactive minerals. (auth)

1363

URANIUM DEPOSITS IN THE EUREKA GULCH AREA, CENTRAL CITY DISTRICT, GILPIN COUNTY, COLORADO. P. K. Sims, F. W. Osterwald, and E. W. Tooker. U. S. Geol. Survey Bull. 1032-A, 1955. 31p. plus 1 illus. $0.50 (GPO)

The uranium and other metals of this area are in or adjacent to steeply dipping mesothermal veins of Laramide age that cut pre-Cambrian metasedimentary rocks, granite gneiss, pegmatite, and Laramide intrusive rocks. Pitchblende is present in at least four veins, and metatorbernite, which is associated at places with kasolite, is found along two veins for a linear distance of about 700 ft. The pitchblende- and metatorbernite-bearing ores appear to be mutually exclusive and seem to occur in different veins. Colloform grains of pitchblende were deposited in the veins essentially contemporaneously with pyrite. The pitchblende is earlier in the sequence of deposition than galena and sphalerite. The metatorbernite replaces altered biotite-quartz-plagioclase gneiss and altered amphibolite, and to a lesser extent forms coatings on fractures in these rocks adjacent to the veins; the kasolite fills vugs in highly altered vein material and in altered wall rocks. Much of the pitchblende found on the dumps has been partly leached and is out of equilibrium. Selected samples of metatorbernite-bearing rock from one mine dump contain as much as 6.11% uranium. (auth)

METALS AND METALLURGY

1364 ANL-4912

Argonne National Lab., Lemont, Ill.

METALLOGRAPHIC PREPARATION OF THORIUM. J. E. Baumrucker. Mar. 31, 1952. Decl. Nov. 30, 1953. 19p. Contract W-31-109-Eng-38.

A preparational technique for thorium metallographic specimens is presented and discussed. It features the elimination of water as a lubricant or solvent in the polishing and in the following electrolytic etch: phosphoric acid, 5% (Volume); sulfuric acid, 10% to 15%; nitric acid, 15%; and ethylene glycol, 70% to 65%. The solution is used warm at 42 to 45°C. The specimen, as anode, is agitated manually during electrolysis. Polarity is reversed for 15 to 30 sec at the end of the etch period. Current density is 75 ma/cm^2. Time of etch may vary from 30 sec to 1 min. (auth)

1365 ANL-5449

Argonne National Lab., Lemont, Ill.

ATTACK ON MATERIALS BY LEAD AT 1000°C. W. D. Wilkinson, E. W. Hoyt, and H. V. Rhude. Oct. 1955. 30p. Contract W-31-109-Eng-38.

This is the Final Report on Program 8.2.2 and covers work done prior to December 1, 1949.

A method for determining the resistance of materials to attack by Pb at 1000°C is described. Results of preliminary tests indicate that sintered beryllia, fused silica, Ta, and probably Nb and a sintered mixture of beryllia and urania have good resistance. SAE-1020 carbon steel, Type 430 stainless steel, Cr, Type 347 stainless steel, Type 302 stainless steel, Inconel, Mo, Armco iron, Zr, and titanium, had fair to poor resistance to attack by Pb, in decreasing order as listed. Cast Fe and U underwent complete dissolution. (auth)

1366 ATI-203413

Ryan Aeronautical Co., Lindbergh Field, San Diego, Calif.

TITANIUM FORMABILITY AND WELDING CHARACTERISTICS. Monthly Progress Report No. 10. B. Holland and [John J. Roszler]. Aug. 10, 1953. 22p. Contract AF 33(600)22169. (G-17-55).

Investigations were continued on the cold and hot forming and sigma-fusion welding of stainless steel and Ti alloys. (For preceding period see AD-17366.) (C.W.H.)

1367 BMI-781

Battelle Memorial Inst., Columbus, Ohio.

ELECTRODEPOSITION OF BERYLLIUM, THORIUM, AND ZIRCONIUM FROM FUSED-SALT BATHS. J. A. Gurklis, J. G. Beach, and C. L. Faust. Nov. 4, 1952. Decl. Aug. 31, 1955. 26p. Contract W-7405-eng-92.

A brief investigation was made of the electrodeposition of Be, Th, and Zr from fused-salt baths. Bright, flakelike Be, resembling the laminar appearance of mica crystals, was produced by electrolysis of $BeCl_2$ plus KCl–LiCl baths. Spangles $\frac{1}{4}$ to $\frac{1}{2}$ in. across showed some ductility. A few dendrites $\frac{1}{2}$ in. long and $\frac{1}{16}$ in. across were also obtained. Impurities in the Be, such as Al, Fe, and Mg were appreciably reduced by electrorefining. The purity compares favorably with that of vacuum distilled Be. Dendritic Th about 1 in. long and $\frac{1}{8}$ to $\frac{1}{4}$ in. across was produced by electrolysis of $ThCl_4$ plus KCl–LiCl baths. Analyses of this material indicated electrorefining, in that impurities such as Fe, Ni, Cu, Cs, Be, and Al were appreciably reduced. The purity was similar to that of iodide thorium. Dendritic Zr (20-48 mesh) was produced by electrolysis of a ZrF_4 plus KCl–LiCl bath. Powdered Zr was obtained from the $ZrCl_4$ plus KCl–LiCl bath. (auth)

1368 BMI-957

Battelle Memorial Inst., Columbus, Ohio.

TRANSFORMATION KINETICS OF URANIUM–MOLYBDENUM ALLOYS. H. A. Saller, F. A. Rough, and A. A. Bauer. Oct. 21, 1954. Decl. Aug. 4, 1955. 26p. Contract W-7405-eng-92.

The kinetics and mode of transformation of metastable gamma in the U-Mo system have been investigated. Electrical resistance measurements made during isothermal transformation, supported by metallographic and hardness data, indicate the gamma-to-delta transformation to be an ordering reaction which probably proceeds by nucleation and growth of the ordered phase. A "C-curve" type behavior for the transformation is inferred from resistance measurements and metallographic observations of the 30 at.% alloy. An aging effect is attributed to coherency stresses in the matrix prior to

precipitation of the ordered phase. The gamma phase of the 21 at.% Mo alloy decomposes by a nucleation and growth mechanism to yield a lamellar distribution of the alpha and delta phases. The ordered, intermediate phase, delta, is body-centered tetragonal with a_0 = 6.84 A and c_0 = 6.55 A. The solubility limits on the high-U side of the delta phase are substantiated. (auth)

1369 BMI-1052

Battelle Memorial Inst., Columbus, Ohio.

THE ELECTRICAL RESISTANCE OF THORIUM THROUGH THE ALLOTROPIC TRANSITION. Herbert W. Deem and Robert A. Winn. Nov. 18, 1955. 10p. Contract W-7405-eng-92.

The electrical resistance-temperature curve of Th exhibits a reversible inflection at about 1400°C corresponding with the allotropic transition in this vicinity. Resistance data indicate that such impurities as C, N_2, and O_2 raise the transformation temperature. (auth)

1370 COO-207

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

A STUDY OF THE MECHANISMS OF HEAT TREATMENT OF ZIRCONIUM-BASE ALLOYS. Summary Report No. 2 [for] July 1, 1954–June 30, 1955. R. F. Domagala and D. J. McPherson. Aug. 3, 1955. 94p. Project No. B-068. Contract AT(11-1)-315.

A systematic and scientific approach to the realization of optimum properties in zirconium-base alloys through a alloying and heat treatment was studied. The work was concerned with three prototype systems: Zr–Mo eutectoid; Zr–Ti α and β isomorphous (continuous series of α and β solid solutions); and Zr–Sn peritectoid. All alloys were prepared with sponge zirconium. No so-called "beta isomorphous" type diagram, where a restricted alpha solubility and a continuous series of beta solid solutions exist, is known for zirconium-base alloys. A cursory check of Zr–Ta and Zr–Nb alloys was carried out to determine if either system formed such a diagram. Both systems were found to be eutectoid and a beta isomorphous system remains unknown among zirconium binary diagrams. (auth)

1371 IGR-TN/C-250

Gt. Brit. Culcheth Labs., Culcheth, Lancs. England.

THE SOLUBILITY OF NICKEL IN LITHIUM. K. Q. Bagley and K. R. Montgomery. Sept. 30, 1955. 14p. (IGC-XMPDC/P12; IGC-XMWP/P5)

The solubility of Ni in Li has been determined in the temperature range 200 to 650°C. The results indicate that the solubility rises slowly from 60 ppm. at 200°C to 220 ppm. at 500°C, then more rapidly to 0.2% at ~675°C. It is concluded that 'cold trapping' at 400 to 500°C will reduce the Ni content in a Li coolant to a tolerable level. The method adopted in the determinations was to analyze the filtrate obtained on forcing a Li–Ni solution through a stainless steel sinter at a known temperature. Some erosion of the filter disc was observed, and analytical results required correction to take into account the concentration of Ni present as stainless steel particles in the filtrate. An alternative type of apparatus is described which avoids the use of metal sinters, and eliminates complications due to the possible solubility of Fe and Cr in Li. (auth)

1372 KAPL-1411

Knolls Atomic Power Lab., Schenectady, N. Y.

JOINT AEC-ASME PROGRAM ON THERMAL STRESS FATIGUE. Final Report. L. F. Coffin, Jr. Sept. 21, 1955. 60p. Contract W-31-109-Eng-52.

Earlier work on the thermal stress fatigue resistance of AISI Type 347 stainless steel is summarized. The investigation was to provide additional qualitative experimental support of the concept of fatigue design based on an allowable stress range which is embodied in the ASA-B31.1 Code Rules for Piping Flexibility Design. Ivestigation of the effect of cycling which produces tensile rather than compressive stress under the hot condition showed that there was no significant difference. Investigation of the effect of reducing the net mechanical strain range for a given temperature range to a point approaching the design strains for a piping system showed that while the temperature range was held constant, the trend of reducing the net mechanical strain range was to increase the number of cycles to failure similar to that obtained when the net mechanical strain range was reduced by lowering the temperature range under full constraint. In addition, for the same mechanical strain range, widening the temperature range decreased the number of cycles to failure. (auth)

1373 NP-5819

Case Inst. of Tech., Cleveland.

HIGH TEMPERATURE SCALING OF COBALT–CHROMIUM ALLOYS. Technical Report No. 2 for March 1955 to September 1955. E. B. Evans, C. A. Phalnikar, and W. M. Baldwin, Jr. Oct. 1955. 58p. Project No. 5B99-01-004. Contract DA 33-019-ORD-1077.

Scaling rates and scale compositions of Co–Cr alloys were determined in the temperature range of 900 to 1200°C. At any given temperature the scaling rate increased with low chromium additions, then dropped precipitously with further additions reaching a minimum at about 25% chromium. Thereafter the scaling rate again increased approaching the scaling rate of chromium as the upper limit. Above a critical concentration of about 25% chromium, the scale consisted exclusively of Cr_2O_3. Below this critical concentration, complex scales consisting of the oxides of both cobalt and chromium were formed. The best scaling resistance was associated with a scale consisting predominantly of Cr_2O_3, not spinel. Schematic isothermal sections of the deduced Co–Cr–O phase diagram were applied as an aid in interpreting the scaling behavior. It is concluded that none of the current theories of scaling of alloys describes the present case. (auth)

1374 NP-5825

Air Materiel Command, Wright-Patterson AFB, Ohio and Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

TITANIUM AND TITANIUM ALLOYS PROGRAMS. Book 1. [1955]. 43p.

1375 NP-5826

Air Materiel Command, Wright-Patterson AFB, Ohio and Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

TITANIUM AND TITANIUM ALLOYS PROGRAMS. Book 2. [1955]. 97p.

1376 NP-5827

Air Materiel Command, Wright-Patterson AFB, Ohio and Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

TITANIUM AND TITANIUM ALLOYS PROGRAMS. Book 3. [1955]. 80p.

1377 NP-5828

Air Materiel Command, Wright-Patterson AFB, Ohio and Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

TITANIUM AND TITANIUM ALLOYS PROGRAMS. Book 4. [1955]. 129p.

1378 NP-5829

Air Materiel Command, Wright-Patterson AFB, Ohio and Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

TITANIUM AND TITANIUM ALLOYS PROGRAMS. Book 5. [1955]. 77p.

1379 NP-5834

Driver-Harris Co., Harrison, N. J.

TITANIUM ALLOY WIRE DRAWING PRACTICES. DEVELOPMENT OF PRACTICES FOR COMMERCIAL PRODUCTION OF TITANIUM AND TITANIUM ALLOY WIRE. Summary Report No. 1 [covering the period] Aug. 1, 1952 to June 20, 1955. 34p. O. O. Project TB 415. Contract DA-30-069-ORD-870.

The primary technical factors involved in the manufacture of titanium and titanium alloy wire have been studied, with the specific purpose of establishing initial practices for commercial production of wire. The factors studied included: cleaning methods, to produce proper surface conditions on hot rolled rods, on wire in process, and on finished wire, lubricants and coatings, for wire being drawn, wire drawing–die design, drafts, speeds, and annealing methods. (auth)

1380 NP-5835

Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.

THE ENGINEERING APPLICATION OF THE ABSOLUTE RATE THEORY TO THE CREEP OF LEAD. Technical Report No. 48. Mervin B. Hogan. May 15, 1955. 83p. Project No. N7-032-168. Contract N7-onr-45101.

Creep of Pb data from three different published sources are analyzed from the standpoint of the absolute rate theory. The metallurgical complexity of Pb and the influence of alloying elements and other factors upon its mechanical properties are discussed. The four-element mechanical model is used as the basis of the analyses. It is concluded that the absolute rate theory provides an excellent hypothesis for engineering application to the creep of Pb. (auth)

1381 NP-5836

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

IMPACT PROPERTIES OF QUENCHED AND TEMPERED ALLOY STEELS. Final Report. H. Schwartzbart and J. P. Sheehan. Sept. 19, 1955. 113p. Project No. NR 031-115. Contract N6 onr 274 T. O. I.

The effects of the following variables on the impact properties of quenched and tempered alloy steels have been investigated: carbon content, alloy grade, Mo/P ratios, boron and rare-earth additions, grain size, homogeneity, and specimen size. (C.W.H.)

1382 NRL-4650

Naval Research Lab., Washington, D. C.

TRANSFORMATION STUDIES OF SUBSTITUTE SPECIAL TREATMENT STEELS. PART I. COMPARISON OF TRANSFORMATION DIAGRAMS. Lester F. Spencer and Richard H. Raring. Oct. 3, 1955. 16p.

In view of the potential shortage of nickel and other alloying elements, it is essential to develop substitute armor compositions that contain a minimum of critical metals. Two steels, enriched modifications of AISI 8727 and 87B27, which are being considered as substitutes for Ni–Cr STS, were compared on the basis of transformation characteristics and end-quench hardenability with a production sample of Ni–Cr STS. Isothermal transformation diagrams determined metallographically and continuous-cooling transformation diagrams determined dilatometrically indicate points of similarity and dissimilarity between the substitute steels and the standard Ni–Cr STS armor. (auth)

1383 NYO-7050

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE STRUCTURE OF LITHIUM–MAGNESIUM SOLID SOLUTIONS. PART II. MEASUREMENTS OF DIFFUSE X-RAY SCATTERING. Technical Report No. 28. F. H. Herbstein and B. L. Averbach. Sept. 30, 1955. 24p. Contract AT(30-1)-1002, Scope II.

Diffuse x-ray scattering data from BCC solutions of Li–Mg alloys indicate a preference for unlike nearest neighbors, and the short range order coefficients have been measured as a function of composition. Size effect coefficients have also been determined and these indicate that individual atoms are displaced from the average lattice sites. The lattice parameter minimum at 65 at. % Li coupled with the variation of the size effect coefficients with composition suggests that the Li–Mg interatomic distance is shorter than the average of the distances between like atoms, and the interatomic distances have been calculated. The hexagonal solid solutions appear to be almost random with no size effects. (auth)

1384 NYO-7053

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

LOCAL ATOMIC DISPLACEMENTS IN SOLID SOLUTIONS. Technical Report No. 31. F. H. Herbstein, B. S. Borie, Jr., and B. L. Averbach. Oct. 21, 1955. 21p. Contracts AT(30-1)-1002, Soope II, and AT(30-1)-858.

The static displacements of atoms in binary solid solutions from the sites of the average lattice can be determined from measurements of the Bragg intensities. Appreciable local static displacements have been found in the disordered alloys Cu_3Au, CoPt, NiAu and LiMg. For the first three alloys, a good correlation between these measurements and those of the size-effect diffuse scattering was obtained using a theory which is based on an elastic model of the solid solution. The present measurements also confirm the essential correctness of the atomic displacements previously deduced from diffuse-scattering measurements. (auth)

1385 NYO-7055

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

HALL EFFECT IN SOLID SOLUTIONS. Technical Report No. 33. W. F. Flanagan and B. L. Averbach. Nov. 18, 1955. 7p. Contract AT(30-1)-1002, Scope II.

The Hall Effect has been measured in Au–Ni, Cu–Ni, Au–Ag and Cu–Au solid solutions at 80 and 300°K as a function of composition. The apparent number of conduction electrons is not linear with composition in the Au–Ag and Au–Cu alloys and it is proposed that this effect is

caused by the presence of diffuse Brillouin zone boundaries which arise from the short-range order. (auth)

1386 NYO-7477

Franklin Inst. Labs. For Research and Development, Philadelphia.

DIFFUSION IN METALS. Technical Progress Report. Dec. 1955. 6p. Contract AT-(30-1)-1484.

Graphical data are given on specific activity vs. distance along the surface for surface diffusion of Zn on Zn. (J.E.D.)

1387 TML-19

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

A GENERAL SUMMARY OF THE PHYSICAL METALLURGY OF TITANIUM ALLOYS. R. I. Jaffee. Oct. 18, 1955. 81p. Contract AF 18(600)-1375.

A short summary of the extensive literature on titanium-alloy physical metallurgy is reported. It covers alloying elements and alloy types, and describes the general effects of interstitials. The mechanical properties of annealed alloys and the dependence of properties on structure are described. The second half of the report is devoted to heat treatment and thermal stability of alpha-beta and beta alloys. A short section on future trends in alloy development is presented. (auth)

1388 TML-20

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE EFFECTS OF CARBON, OXYGEN, AND NITROGEN ON THE MECHANICAL PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. H. R. Ogden and R. I. Jaffee. Oct. 19, 1955. 99p. Contract AF18(600)-1375.

The effects of the alpha solute interstitials C, O, and N on the mechanical properties of titanium alloys are reviewed. These interstitial elements strengthen titanium, although this effect is lost at elevated temperatures. At room temperatures the interstitials have little effect on tensile ductility, but at subzero temperatures they promote embrittlement. They also have a deleterious effect on toughness, notch sensitivity, weld ductility, machinability, and bend ductility. The strengthening effect of either individual or combined interstitials can be grouped in terms of an oxygen equivalent. It has been found that 0.1% nitrogen is approximately equivalent to 0.2% oxygen or 0.3% carbon. Thus, the oxygen equivalent becomes oxygen equivalent = $\%O + 2 \times \%N + \frac{2}{3} \times \%C$. The oxygen equivalent is related to hardness as follows: $Bhn = 40 + 310 \sqrt{\text{oxygen equivalent}}$. (auth)

1389 TML-21

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE DIFFUSION OF INTERSTITIAL AND SUBSTITUTIONAL ELEMENTS IN TITANIUM. J. E. Reynolds and R. I. Jaffee. Oct. 24, 1955. 22p. Contract AF18(600)-1375.

The self-diffusion of titanium has not been determined, but the activation energy for this process has been estimated to be 77,000 cal/mol. Diffusion data are available for carbon, oxygen, nitrogen, and hydrogen in alpha titanium and beta titanium. Additional interstitial diffusion data have been obtained in an air-contamination study of three commercial titanium alloys. Data on substitutional diffusion are meager, but some information is available on chromium, molybdenum, iron, and zirconium diffusion in titanium. Lack of systematic studies in this category may severely limit progress in the interpretation of solid-state reactions in titanium alloy development. The theoretical and practical uses of diffusion data in general are reviewed. (auth)

1390 USBM-U-3

Northwest Electrodevelopment Lab., Albany, Oreg.

DISTRIBUTION OF IMPURITY ELEMENTS IN BUREAU OF MINES ZIRCONIUM SPONGE. Report No. 4 Covering period November 10, 1953 to June 30, 1954. D. D. Harper. Nov. 1954. 40p. Contract AT(11-1)-140.

Results of a survey of the distribution of impurity elements in cleaned zirconium sponge produced at Albany, Oregon are presented. Special attention has been given to the distribution of iron, silicon, aluminum, and nitrogen in the final sponge. Graphs which relate weight percentage of sponge to maximum and average concentration in parts per million are shown for these four impurity elements. Information is also given concerning the percentage of the total sponge and the percentage of each type that met established specification limits. (auth)

1391 WADC-TR-52-291(Pt.III).

American Electro Metal Corp., Yonkers, N. Y.

AN INVESTIGATION OF VARIOUS PROPERTIES OF NICKEL ALUMINIDE. PART III. INVESTIGATION OF THE INTERMETALLIC COMPOUNDS OF ALUMINUM. Period covered August 1953 to August 1954. W. H. Herz. Apr. 1955. 76p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF(038)-10716.

Modification of NiAl by the addition of Zr or Ti has produced products with improved high temperature properties without decreasing the oxidation resistance. NiAl + 4% Zr is so far the best, having an excellent oxidation resistance (a weight gain of 2.9 mg/cm^2 after 260 hours in air at 1000°C), a transverse rupture strength of 130,000 psi at room temperature and 160,000 psi at 1100°C, and a stress rupture life of 100 hr at 1000°C and 12,000 psi. Impact strength of this material varies considerably, needing much development work to achieve consistency. The best results in the NACA drop impact tests are over 15 inch-pounds, with the average being between 4 and 6 inch-pounds. These materials can be handled by hot pressing, cold pressing and sintering, slip casting, and hydrostatic pressing, with machining in the pre-sintered state making complicated shapes possible. A method of homogenizing and purifying gamma TiAl was developed, and the first physical tests were made with this improved material. (See also WACD-TR-52-291.) (auth)

1392 WADC-TR-53-190(Pt.3)

American Electro Metal Corp., Yonkers, N. Y.

NEW HIGH TEMPERATURE INTERMETALLIC MATERIALS. [Summary] Report [for] November 1, 1953 through November 30, 1954. William Arbiter. Dec. 1954. 98p. Project No. 7350. Contract AF33(616)-109. (AD-63502)

The average properties of a large number of compositions in the Cr–Ti–O and the Cr–Ti–O–N systems are given. A comparison of the properties of similar compositions in the two systems is made and this indicates that nitrogen additions increase brittleness while increasing high-temperature strength. All of the Cr–Si and Ti–Si systems tested showed brittle behvaior and attempts to modify this behavior by the addition of metallic binders

resulted in little improvement. Compositions in the Co-Cr-Mo system consisting of substantial amounts of the phase have shown some promise in high-temperature applications. Despite the appreciable quantities of the σ phase, the impact resistance has remained relatively high. [For preceding period see WADC-TR-53-190(Pt.2).] (auth)

1393 WADC-TR-54-305(Pt.II).
Avco Mfg. Corp., Stratford, Conn.
HANDBOOK ON TITANIUM. [Period covered:] March 1954 to March 1955. Heinrich K. Adenstedt. Sept. 1955. 56p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF 33(616)-2222.

Information has been collected on specific properties of titanium and procedures for the treatment and utilization of titanium and its alloys by literature survey and by personal contact with the proper persons and institutions. The data have been evaluated and are condensed in this report. The two major sections of titanium technology covered are: laboratory procedures and fabrication. (auth)

1394 WADC-TR-54-487
Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF GRAIN SIZE ON THE MECHANICAL PROPERTIES OF TITANIUM AND ITS ALLOYS. [Summary Report covering the period from March 18, 1953 through June 30, 1954. Frank C. Holden, Horace R. Ogden, and Robert I. Jaffee. Mar. 1955. 150p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF 33(616)-412.

The effects of grain size on the mechanical properties of commercial-purity titanium, an alpha-beta-titanium alloy, and a metastable beta-titanium alloy were studied. The mechanical properties studied were tensile, notched-tensile, hardness, bend, impact, and fatigue endurance. For unalloyed titanium, grain size or shape has only a minor effect on the mechanical properties. Yield strengths are decreased slightly for specimens annealed in the alpha-beta range, because of the partition of impurities to the nonmatrix alpha. Impact resistance is highest for the smallest alpha grain sizes. Bend ductility and tensile ductility are excellent for all grain sizes. The fatigue endurance limit at 10^7 cycles is 79% of ultimate strength for unnotched and 42% for notched specimens. The grain size of the metastable beta alloy (Ti-7.5Cr-7.5Mo) also has only a minor effect on the mechanical properties so long as the alloy is single phase. The presence of alpha in the structure lowered the bend ductility, tensile ductility, and impact resistance. Notched fatigue properties appear to be relatively unaffected by changes in grain size or microstructural condition. The plates of alpha phase in the beta matrix act as stress raisers similar to notches and lower the unnotched endurance limit. The alpha-beta alloy (Ti-2.5Cr-2.5Mo) was tested in the stabilized condition so that the only variables would be grain size and grain shape. Only minor changes in properties occurred as a result of changing the alpha-beta grain size. Strengths were unaffected by changing grain shape, although the equiaxed alpha-beta specimens had higher tensile ductilities and impact resistance than the acicular alpha-beta specimens. The fatigue endurance limits generally were unaffected by grain size or shape. The unnotched fatigue strength was 34% of the ultimate tensile strength, and the notched fatigue strength was 20% of the ultimate tensile strength. Vacuum annealing to remove hydrogen had little effect on the properties because these alloys contained only 30 to 60 ppm hydrogen originally. (auth)

1395 WADC-TR-54-588
Carnegie Inst. of Tech., Pittsburgh.
EFFECT OF AUSTEMPERING, MARTEMPERING, AND INTERRUPTED QUENCHING ON TRANSVERSE PROPERTIES AND DISTORTION AND STRAIN AGING ON YIELD-TENSILE RATIO. John Vajda, John J. Hauser, Paul E. Busby, Cyril Wells, and Robert F. Mehl. Dec. 1954. 43p. Project title: SUPPORTING RESEARCH ON HIGH STRENGTH STEEL FOR AERONAUTICAL APPLICATIONS. Contract AF33(616)-2286. (AD-63962)

Studies of the effect of martempering, austempering, and interrupted quenching on transverse mechanical properties revealed that cylinders of AISI 4340 as large as 2 in. in diameter and of AISI 4350 at least up to 3 in. in diameter can be heat treated by martempering or interrupted quenching, followed by tempering, to give properties quite similar to those obtained when small specimens of these steels are subjected to a conventional oil quench and a tempering treatment to produce a tensile strength between 250,000 and 280,000 psi. Results of distortion tests made on these two steels indicated that the magnitude of distortion produced by "martempering" at temperatures in the range above M_s to room temperature is a minimum at an intermediate temperature dictated by chemical composition and specimen size. The shapes of the curves of distortion versus "martempering" temperature are not unlike the normal "C" curves for isothermal reactions, and the positions of the curves for the two steels are such that both the distortion and temperature values at the knee of the curve are lower for the 4340 than for the 4350. Longitudinal tensile test data obtained after strain aging AISI 4340 indicated that the yield strength can be raised without seriously impairing ductility by introducing strain either by tensile stress or by rolling and then aging in the range 212° to 572°F. (auth)

1396 WADC-TR-55-5
Case Inst. of Tech., Cleveland.
TENSILE PROPERTIES AND RHEOTROPIC BEHAVIOR OF TITANIUM ALLOYS AND MOLYBDENUM. Conducted from August 1953 to February 1955. E. J. Ripling. May 1955. 134p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF 33(616)-2223.

The unnotched and notched tensile properties are described as a function of testing temperature for a series of Ti-N and Ti-Mn binary alloys as well as for the commercial alloy, Ti 140A, and the experimental 3 Mn-complex alloy. It was shown that the N embrittles α Ti by elevating its transition temperature. This brittleness can be partially eliminated by taking advantage of a rheotropic recovery. The Ti 140A alloy in the "as-received" condition was high in H so that a brief investigation of the effect of H in this alloy was also conducted. Recrystallization embrittlement in commercial unalloyed Mo was found to be a manifestation of rheotropic brittlement. (auth)

1397 WADC-TR-55-23
Allegheny Ludlum Steel Corp. Research Lab., Watervliet, N. Y.
DEVELOPMENT OF WROUGHT AND CAST ALLOYS FOR HIGH TEMPERATURE APPLICATIONS. R. R. Mac-

Farlane, R. S. DeFries, E. E. Reynolds, and W. E. Dyrkacz. Apr. 1955. 92p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-2463.

Developmental studies were conducted on wrought Fe-base and both wrought and cast Co-base alloys for applications at high temperatures. A heat treatable, Fe-base, austenitic alloy containing Mn and Cr was modified with B to give excellent stress-rupture properties at 1200°F. Oxidation resistance was greatly improved by small Al additions. A wrought Co-base alloy with good stress-rupture properties at 1600 and 1700°F and improved oxidation resistance was developed. Composition levels giving optimum properties were determined for the cast Co-base alloys. Modifications involving B were investigated in both wrought and cast Co-base alloys. (auth)

1398 WAL-401/241

Watertown Arsenal Labs., Mass.

TRUE STRESS-TRUE STRAIN PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. Eric Kula and Frank R. Larson. Sept. 2, 1955. 65p. DA Project 598-08-021.

Several heats each of a variety of titanium base compositions were tested in order to determine their true stress-true strain properties in tension. Microstructures and chemical compositions of these various metals were also determined. The strain hardening properties, maximum uniform true strain, true strain at fracture and the flow stress properties as a function of microstructure and chemical composition are recorded herein. Results for both mill annealed and vacuum annealed specimens are reported. With the restriction that the tests were conducted upon commercially available material in the as-received or vacuum annealed conditions, the following conclusions may be drawn: For titanium with an all-alpha microstructure the true strain at fracture appears to be independent of the ultimate tensile strength of the material and was 0.65, corresponding to a reduction in area of 48%. For titanium with a mixed alpha-beta microstructure the true strain at fracture was dependent upon the strength of the material, and materials with the higher strengths usually had lower true strains at fracture. For all materials examined, with a few exceptions, the rate of strain hardening, as described by n in the equation $\sigma = S_1\epsilon^n$, was .15 ± .02. For specimens with a high hydrogen content (greater than 0.025 wt %), vacuum annealing increased the true strain at fracture without appreciably affecting the true stress. For titanium with an all-alpha microstructure the combined strengthening effects of interstitial alloying elements converted to atomic percent nitrogen, as previously reported, is essentially substantiated. (auth)

1399 WAPD-25

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PRELIMINARY REPORT ON THE ELECTRICAL RESISTIVITY OF ZIRCONIUM. L. A. Cook, L. S. Castleman, and W. E. Johnson. Dec. 20, 1950. Decl. Sept. 12, 1955. 21p. Naval Reactor Program; Contract AT-11-1-GEN-14.

Preliminary data have been obtained concerning the effects of temperature, cold work, irradiation and alloying additions of U upon the electrical resistivity of Zr. The resistivity vs temperature curve for Zr has a relatively constant slope from −186 to 200°C. Above 200°C, the slope of the curve decreases smoothly, and the resistivity approaches a maximum value in the vicinity of the $\alpha \rightleftharpoons \beta$ transition temperature (about 860°C), dropping abruptly thereafter to a minimum between 875 and 950°C. Above 950°C, the resistivity rises gradually and again with constant slope. Cold work introduced by swaging operations has no effect upon the slope of the resistivity vs. temperature curve at room temperature; however, the magnitude of the resistivity is increased by 4 to 6% after an 84% reduction in area. Also, the preferred orientation resulting from an 84% reduction in area followed by an anneal above the recrystallization temperature increases the resistivity by about 2%. Irradiation of one sample of Zr indicates that the resistivity of Zr increases by about 3% after a six months' exposure in neutron fluxes characteristic of those found in a Hanford process hole. (auth)

1400

SURFACE BARRIER ANALYSIS FOR METALS BY MEANS OF SCHOTTKY DEVIATIONS. D. W. Juenker (Univ. of Notre Dame, Ind.). Phys. Rev. 99, 1155-60(1955) Aug. 15.

The transmission coefficient for the mirror-image barrier at a metal surface is applied to the case of photoelectric emission. The distribution over which the coefficient is averaged is that given by Fowler for energies normal to the emitter surface, and is altered by the Schottky barrier lowering. The average differs from unity by an amount the major part of which is a periodic function of the accelerating field, giving a periodic deviation from the photoelectric Schottky effect which differs from the thermionic deviation only in amplitude. A refinement in the computation of the unaveraged periodic transmission coefficient brings the theory for thermionic deviations into agreement with that of Miller and Good. The improved form of the thermionic deviation is applied to experimental data to evaluate the complex reflection coefficient μ characterizing the potential form in the immediate vicinity of the surface. The values of $|\mu|$ so obtained for the highly refractory metals are of the order of 0.4, as compared with 0.2 predicted on the basis of the box model. (auth)

1401

EFFECTS OF NIOBIUM AND TITANIUM ON THE PROPERTIES OF STAINLESS STEEL. A. M. Samarin and A. A. Yuskevich. Invest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 10, 107-16(1955) Oct. (In Russian)

Experiments with various steels proved that niobium is more effective than titanium in increasing steel resistance to intercrystalline corrosion. Niobium improves the welding properties of steel and the wear resistance of tempered steel to acid. (R.V.J.)

1402

CHEMICAL ANALYSIS OF THIN FILMS BY X-RAY EMISSION SPECTROGRAPHY. T. N. Rhodin (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Anal. Chem. 27, 1857-61(1955) Dec.

X-ray emission spectrography has been applied to the quantitative analysis of thin (approximately 100 A) evaporated films of Fe, Ni, Cr, and Types 304, 316, and 347 stainless steels deposited on Mylar polyester backing. Oxide films associated with passivity and atmospheric oxidation, isolated from Types 304, 316, and 347 stainless steels, were also studied. The corresponding surface densities of the sample films varied from 1 to 100 × 10^{-6} g/cm^2. Analytical sensitivities for the three metals corresponding to a counting rate of 60 cpm ± 5% are 0.037, 0.061, and 0.175 × 10^{-6} g/cm^2 for Ni, Fe, and Cr, respectively. Comparison of the metallic compositional data obtained by x-ray methods for

metal and oxide films 300 A in thickness or less to those obtained independently by microcolorimetric methods indicates excellent agreement. (auth)

1403

THE MAGNETIC SUSCEPTIBILITY OF METALLIC CERIUM. L. F. Bates, S. J. Leach, and R. G. Loasby (Univ. of Nottingham, England). Proc. Phys. Soc. (London) B68, 859-61(1955) Nov. 1.

The magnetic susceptibility of pure metallic cerium has been measured over the temperature range 90 to 1057°K. At 293°K, the susceptibility is 17.5 ± 0.2 e.m.u. per gram, and between 90 and 295°K, the relation $\chi = 0.00588/(T + 42)$ is followed. The observed temperature variation of susceptibility can be explained on the basis of a change in thermal population of $^2F_{5/2}$ and $^2F_{7/2}$ levels separated by 1340 cm^{-1}, upon which is superimposed a small temperature-independent paramagnetism. (auth)

1404

HALL COEFFICIENT AND RESISTIVITY OF α- AND β-BRASS FROM 20-600°C. V. Frank. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 30, No. 4, 1955. 13p.

The Hall coefficients and resistivities of Cu–Zn alloys in the α- and β-range have been determined by an A.C. method. The observed resistivities are in agreement with earlier results. The sign of the Hall coefficient is normal for all specimens investigated; in the α range, R_H decreases with increasing Zn content more rapidly than predicted by free electron theory and shows a strong temperature dependence for the Zn rich alloys. For β brass, R_H is practically proportional to the resistivity for various temperatures including the temperature range of the order-disorder transition. Some implications of the results for the band structure of these alloys are suggested. (auth)

1405

TEMPERATURE EFFECTS ON DENSITY AND ELECTRO-CONDUCTIVITY OF Te–Se MOLTEN ALLOYS. N. P. Mokrovskiĭ and A. R. Regel. Zhur. Tekh. Phys. 25, 2093-6(1955) Dec. (In Russian)

Analyses proved that in temperature near the melting point tellurium retains its chain-like structure. At higher temperature, metallization bonds increase while the chain structure and valence bonds disintegrate. At 550°C tellurium becomes practically a metal. Addition of selenium slows down the disintegration process in the chain structure. (R.V.J.)

1406

DECOMPOSITION STRESS OF CERTAIN LEAD COMPOUNDS IN MOLTEN SODIUM HYDROXIDE. Yu. K. Delimarskiĭ, P. P. Turov, and E. B. Gitman. Zhur. Priklad. Khim. 28, 1170-3(1955) Nov. (In Russian)

Decomposition stress of lead oxide and lead dioxide systems dissolved in molten sodium hydroxide was measured. Checking analyses were made for the decomposition stress of sodium hydroxide and PCO–NaOH. The current-tension curves were taken on iron and nickel electrodes. (R.V.J.)

1407

EXTRUSION OF BORIDE, CARBIDE, AND NITRIDE POWDERS OF HIGH MELTING POINT METALS. G. V. Samsonov and V. S. Neshpor (Moscow Inst. of Non-ferros metals.) Doklady Akad. Nauk S.S.S.R. 104, 405-8(1955) Sept. 21. (In Russian)

The expansion rates of contact surfaces were studied by measuring the electroconductivity of the briquettes, during compression process. Powders of various combinations of WC, TiC, ZrC, TiB_2, ZrB_2, TiN, and ZrN were investigated. (R.V.J.)

1408

ULTRAVIOLET MICROSCOPIC INVESTIGATION OF TITANIUM, NIOBIUM, AND CARBON ALLOY STRUCTURES. V. P. Elyutin, M. L. Bernshteĭn, and Yu. A. Pavlov. (Moscow Inst. of Steel). Doklady Akad. Nauk S.S.S.R. 104, 546-8 (1955) Oct. 1. (In Russian)

The structures and properties of titanium–niobium alloy samples, melted in vacuum furnaces of graphite were studied. The content of niobium varied from 1.5 to 88.4%; content of carbon was within 0.7 to 0.9%. The samples were tempered in a vacuum at 1000°C. Ultraviolet microscopic studies determined the phase character of some multi-component systems occurring in some samples. (R.V.J.)

1409

POWDER METALLURGY MAKES BETTER REACTOR FUELS AND COMPONENTS. Nucleonics 13, No. 12, 24-6(1955) Dec.

The techniques and advantages of powder metallurgy for reactor uses are summarized. In particular, the powder metallurgy of Th and U is discussed. (B.J.H.)

1410

A SURVEY OF IRRADIATION EFFECTS IN METALS. J. W. Glen (Royal Society Mond Lab., Cambridge, England). Advances Phys. 4, 381-478(1955) Oct.

The effects of irradiation on the properties of metals are reviewed. Changes in electrical resistance, mechanical properties, allotropic forms, and crystal structure of metals are tabulated. Similar effects in non-metals are discussed. The theory of radiation damage is summarized. 230 references. (C.W.H.)

Refer also to abstracts 1221, 1231, 1236, 1552, 1636, 1637, 1638, and 1645.

PHYSICS

1411 PR-P-27

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PHYSICS DIVISION PROGRESS REPORT [FOR] JULY 1, TO SEPTEMBER 30, 1955. 86p. (AECL-241)

Analysis of the Echo Lake data resulted in a rejection of 55% of the original proton events. The remaining 45% indicate lower interaction probabilities, fewer neutrons per neutron event, and a variance of the number of detected neutrons with incident proton energy. Preparations for further runs are being made. U^{235} depletion in NRX fuel rods has led to a Pu^{239} capture cross section of 425 ± 6 b. Interpretation of the data is continuing. Resonances at 4.90, 5.06, and 5.10 Mev have been observed for Al^{25} $(p,p'\gamma)$ reactions. Spins = $\frac{5}{2}$ are indicated for the 4.90 and 5.10 resonances. Decay of the 1.61- and 1.96-Mev excited states of Mg^{25} and the 1.6-Mev resonance of P^{29} were also investigated. The Van de Graaff accelerator has been equipped with a gas recovery system for He^3 operation. Overall gas loss is 0.1 ml/hr. Good yields from He^3 reactions with C^{12}, N^{14}, and Be^9 are reported. A de-

scription of a newly designed 200 psi A ion chamber for He^3 experimentation is given. Eight weak internal conversion lines of energies >300 kev in Hg^{202} have been identified. Response as a function of source position in 4π ionization chambers was determined. Variations as large as 4% were observed. Data on beta transitions in neutron decay indicate the best values for the coupling constants are: $g_S = 1.38 \pm 0.01 \times 10^{-49}$ ergs cm^3, $g_v < 0.1\ g_S$, T = $1.64 \pm 0.10 \times 10^{-49}$ ergs cm^3, and $g_A < 0.04\ g_T$. B_4C neutron filters made from pressed B_4C-S were found more satisfactory than pressed B_4C-Pb. A theory of the origin of heavy elements in stars is given. An Fe-free $\pi\sqrt{2}\ \beta$ spectrometer was designed; the operational characteristics are given. Lifetime of the 279-kev state in Tl^{203} was determined to be $9 \pm 4 \times 10^{-10}$ sec. In the disintegration of Sm^{153}, the 530-kev γ transition was found to be in coincidence with a 100-kev transition, but not in coincidence with the 69-kev transition. Energy levels in Pb^{208} were determined, and evidence of the order of transitions found. Lifetimes of positrons in superconducting Pb, V, He, A, N_2, and O_2 are reported. The possibility of the large error in Pb^{206} and Bi^{209} proton cross sections being caused by excessive K x rays is discussed. A 172.3-kev γ for Eu^{153} and a 59.57-kev γ for Np^{237} were observed. Methods for improving photomultiplier tube performance at low temperatures was investigated. Intermittant applied voltage removal and exposure to light were found to aid gain recovery. Relative response of four phosphors to γ radiation were determined. Results of investigations of the properties of several commercial Ge transistors are given. Developmental work on amplifiers, kicksorters, coincidence units, and pulse generators is outlined. Theoretical studies of Ca^{43} nuclear properties, binary fission, and surface effects on nuclear reactions were carried out. (For preceding period see PR-P-26.) (D.E.B.)

1412 UCRL-4563

California. Univ., Livermore. Radiation Lab. PARTICLE TRAJECTORIES IN HOMOGENEOUS MAGNETIC FIELD WITH LINEAR TIME DEPENDENCE. Clifford S. Gardner. Aug. 9, 1955. 16p. Contract W-7405-eng-48.

Formulas are derived for the trajectory of a charged particle in a magnetic field which is a linear function of time. Graphs of certain functions are presented, by means of which a trajectory with given initial position and velocity may be plotted. (auth)

1413 AEC-tr-2329

THEORY OF DIFFUSION AND THERMAL DIFFUSION IN DILUTE SOLUTIONS OF He^3 IN HELIUM II. V. N. Zharkov and I. M. Khalatnikov. Translated from Doklady Akad. Nauk S.S.S.R. 93, 1007-9(1953). 4p. Available from Associated Technical Services (Trans. 69G7R), East Orange, N. J.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-1920.

1414 AEC-tr-2330

ROTATION OF HELIUM II AT HIGH VELOCITIES. E. L. Andronikashvili and I. P. Kaverkin. Translated from Zhur. Eksptl'. i Teoret. Fiz. 28, 126-7(1955). 3p. Available from Associated Technical Services (Trans. 70G7R), East Orange, N. J.

Landau's theory predicts a dependency of the He II meniscus on the density of its normal component. Results of experiments designed to measure this dependency are given. (D.E.B.)

1415 AEC-tr-2334

IONIZATION ACCOMPANYING THE BREAKING UP OF DROPLETS IN AN ELECTRIC FIELD. V. M. Muchnik. Translated from Zhur. Eksptl'. i Teoret. Fiz. 26, 109-14 (1954). 7p. Available from Associated Technical Services (Trans. No. 87G6R), East Orange, N. J.

The break-up of water droplets into charged particles due to the presence of an electric field or due to a balloelectric effect was investigated. (C.W.H.)

1416 AEC-tr-2349

PROPAGATION OF ELECTROMAGNETIC SIGNALS IN AN IONIZED GAS. N. G. Denisov. Translated from Zhur. Eksptl'. i Teoret. Fiz. 21, 1354-63(1951). 10p. Available from Associated Technical Services (Trans. 62G7R), East Orange, N. J.

The propagation of electromagnetic signals in a homogeneous ionized gas is discussed. An exact solution is obtained expressed as a Lommel function of two variables. Also an asymptotic form of the solution is obtained for a long group path. (auth)

1417

SECOND VIRIAL COEFFICIENTS OF He^3-He^4 MIXTURES BETWEEN 2 AND 4°K. William E. Keller (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 100, 1021-2(1955) Nov. 15.

P-V isotherms of a gaseous mixture containing 54.75 atomic percent He^3, 45.25% He^4 have been measured at 2.146 and 3.944°K. The values of the second virial coefficients, B_{mix}, obtained from these isotherms are, respectively, −144.5 and −70.0 cc/mole, as compared with −144.9 and −72.8 cc/mole computed from the experimentally determined second virial coefficients of the pure components and the theoretical solution nonideality parameter. It is shown that the solutions are very nearly ideal and that in the temperature range 2 to 4°K reliable values of B_{mix} can be obtained for all compositions. (auth)

1418

OPTICAL PROPERTIES OF CESIUM IODIDE. William S. Rodney (National Bureau of Standards, Washington, D. C.). J. Opt. Soc. Amer. 45, 987-92(1955) Nov.

The refractive indices of CsI were determined at three temperatures near 15, 24, and 34°C for wavelengths from 0.29 micron in the ultraviolet to 53 microns in the infrared. The thermal coefficients of index were determined for each wavelength and all data were reduced to 24°C. A dispersion equation of the Sellmeier type having five terms was fitted to these data. Four of the terms contained absorption wavelengths which were either known experimentally or had been computed from the lattice constants of the crystal. The fifth was adjusted to fit the data and has a value of about 0.02 micron. The formula was extrapolated to infinite wavelength, and the value of n_∞^2 agreed with the known dielectric constant at 30 cm. The dispersion of CsI for infrared wavelengths from about 30 to 40 microns is less than that of CsBr but only by a factor of about 2. At 50 microns the dispersion of CsI is practically equal to the 40-micron dispersion of CsBr. (auth)

1419

ANALYSIS OF VARIANCE OF THE 1952 DATA ON THE ATOMIC CONSTANTS AND A NEW ADJUSTMENT, 1955. E. Richard Cohen (North American Aviation Inc., Downey,

Calif.) and Jesse W. M. DuMond, Thomas W. Layton, and John S. Rollett (California Inst. of Tech., Pasadena). Revs. Mod. Phys. 27, 363-80(1955) Oct.

The 1952 data used by DuMond and Cohen in an evaluation of the atomic constants are analyzed for the presence of systematic errors by a variance analysis performed by an electronic digital computer. For simplicity the velocity of light is treated as a fixed constant of known value and there remain then eleven linear equations in four unknowns subject to least-squares adjustment. Least-squares adjustments of 219 over-determined subsets of these equations have been made and χ^2 has been evaluated for each such subset. An analysis of these data indicates that small systematic errors are most likely to exist in the following input data: (1) The determination of the Faraday by the silver voltameter. (2) The determination of the cyclotron resonance frequency of the proton by the inverse cyclotron method of Bloch and Jeffreys. (3) Certain of the higher voltage determinations of h/e by the continuous x-ray quantum limit. The modifications called for by this analysis yield a new 1955 adjustment in which χ^2 is smaller than it was for the November, 1952 adjustment. The new $\chi^2 = 3.25$ is satisfactorily close to its expected value, 3. Thanks to the fact that the error measures adopted in the November, 1952 adjustment for the output values were conservatively based on the criterion of external consistency, the changes in the values occasioned as a result of the present analysis are all well within those estimated limits. A welcome effect of this new adjustment is that the adjusted output value of λ_g/λ_f, the conversion factor from Siegbahn's x-units to milliangstroms, now lies much closer to the input value. A new table of constants and conversion factors is presented. (auth)

Refer also to abstracts 1162 and 1218.

COSMIC RADIATION

1420

CORRECTION FOR THE EFFECT OF COSMIC RADIATION ON FIELD MEASUREMENTS OF THE RADIOACTIVITY OF SOILS. G. J. McCallum (Dominion Physical Lab., New Zealand). New Zealand J. Sci. Technol. A 37, 172-8(1955) Sept.

The background count rate in the apparatus used for soil radioactivity measurements in the field is analyzed. A formula for calculating the intensity of the cosmic ray background under conditions of varying depths of soil, soil densities, and barometric pressures is developed, and an estimate made of the count rate to be expected from given concentrations of K, U, and Th. (auth)

1421

RESULTS OF OBSERVATIONS OF DISCRETE SOURCES OF COSMIC RADIATION AT $\lambda = 3.2$ cm WAVE LENGTH. N. L. Kaĭdanovskiĭ, N. S. Kardashev, and I. S. Shklovskiĭ. Doklady Akad. Nauk. S.S.S.R. 104, 517-19(1955) Oct. 1. (In Russian)

1422

VARIATION OF THE POSITION OF THE COSMIC-RAY NEUTRON INTENSITY MAXIMUM WITH GEOMAGNETIC LATITUDE. R. K. Soberman, A. Beiser, and S. A. Korff (New York Univ., N. Y.). Phys. Rev. 100, 859-60(1955) Nov. 1.

It has been experimentally demonstrated that there exists a maximum in the cosmic-ray neutron intensity when plotted as a function of altitude or pressure. The position of this maximum at various geomagnetic latitudes in the northern hemisphere has been measured by experiments which used balloon-borne unshielded BF_3 counters with various enrichments of the B^{10} isotope. It has been found that the position of the maximum varies approximately parabolically when plotted as a function of geomagnetic latitude. The range of variation is from about 120 millibars at the equator to about 70 millibars at the north geomagnetic pole. The experimental results are compared with theory. (auth)

1423

COSMIC-RAY ELECTRONS NEAR SEA LEVEL AND AT MOUNTAIN ALTITUDES. Paul R. Barker (Univ. of Michigan, Ann Arbor). Phys. Rev. 100, 860-9(1955) Nov. 1.

A cloud chamber containing aluminum and lead plates has been used to study the intensities and energies of cosmic-ray electrons as a function of altitude and zenith angle. The energy distribution is found to be approximately independent of altitude and zenith angle. The decrease of electron intensity with zenith angle is found to be much less than has been reported by investigators using counter telescopes. The increase of the vertical intensity with altitude is found to be slightly smaller than previously reported. The numbers of electrons resulting from decay and collision processes of μ mesons have been calculated and subtracted from the observed numbers. The residual electrons have an exponential altitude dependence with an absorption length of 135 ± 15 g cm^{-2}, and a zenith-angle dependence which is much less steep than would be expected if they preserved the directions of the primary particles from which they originate. (auth)

1424

ON THE BAROMETER EFFECT ON THE HARD COMPONENT OF THE COSMIC RADIATION. H. Trefall (Imperial Coll. of Sci. and Tech., London). Proc. Phys. Soc. (London) A68, 953-61(1955) Nov. 1.

The interpretation of the observed partial correlation between the meson intensity at sea level and the barometric pressure, the other independent variables of the regression equation being the height of the 100 mb level and the stratospheric temperature, is discussed. It is shown that even though the decay effect due to changes in the height of the meson-producing layer is represented by a separate term in the regression equation, the barometer term does not represent a pure absorption effect but contains also a contribution from the μ-e decay. This decay contribution is due to the relativistic time dilation which makes the mean life of a μ-meson in the atmosphere depend on its energy loss and thereby causes its survival probability to change with changing sea-level pressure even if the height of the meson-producing layer remains constant. The decay effect is found to constitute about one third of the barometric effect observed in experiments performed at sea level. The simple total correlation between the meson intensity and the sea-level pressure is also discussed. (auth)

1425

A SEARCH FOR SECONDARY MAXIMA IN COSMIC RAY TRANSITION CURVES. I. C. B. A. McCusker and B. G. Wilson. Proc. Phys. Soc. (London) A68, 1086-7(1955) Nov. 1.

The secondary maxima in cosmic ray transitions reported by some workers were not found. Search results

show a small effect which is attributed to the decay electrons of μ mesons stopping below the apparatus. (D.E.B.)

1426

A SEARCH FOR SECONDARY MAXIMA IN COSMIC RAY TRANSITION CURVES. II. P. D. McCormack, C. B. A. McCusker, and B. G. Wilson. Proc. Phys. Soc. (London) A68, 1088-9(1955) Nov. 1.

The strong secondary maxima in the Rossi transition curve reported in recent papers failed to appear in a cloud chamber study of narrow angle showers and neutral particle decay. The apparatus and method are given. (D.E.B.)

Refer also to abstracts 1483 and 1484.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1427 MLM-205

Mound Lab., Miamisburg, Ohio.

CRYSTAL STRUCTURE OF SOME COMPOUNDS OF POLONIUM. (Information Meeting Paper No. 15). R. E. Brocklehurst. Sept. 30, 1948. Decl. Nov. 16, 1955. 9p. Contract AT-33-1-GEN-53.

An investigation of polonium valence states is made. Valence states of Po^{2-} and Po^{4+} are confirmed, and the densities and ionic radii of characteristic compounds obtained. (D.E.B.)

1428 MLM-615

Mound Lab., Miamisburg, Ohio.

THE TEMPERATURE OF THE PHASE TRANSITION OF POLONIUM. Final Report. J. M. Goode. Oct. 1, 1951. Decl. Nov. 16, 1955. 21p. Contract AT-33-1-gen-53.

An apparatus is described for obtaining x-ray diffraction data from high-specific-activity radioactive materials without high scatter from cover materials and with little danger of contamination of personnel or equipment. A method for determining the phase-transition temperature of radioactive materials near room temperature is described. The phase transition of α to β polonium was observed to occur at 54 ± 1.5°C. The reverse transition was found to occur at 18 ± 1.5°C. The transition temperature of Po was set at 36 ± 1.5°C. The two phases probably coexist over a short temperature range of either side of 36°C. (auth)

1429 MLM-677

Mound Lab., Miamisburg, Ohio.

METAL–POLONIUM COMPOUNDS. Interim Report. J. M. Goode. Apr. 1, 1952. Decl. Nov. 16, 1955. 22p. Contract AT-33-1-Gen-53.

Compounds of Po and Zn, Pb, Na, Pt, Ni, and Ag have been prepared and investigated by x-ray diffraction. The Zn, Pb, and Na polonides have face-centered-cubic structures with a_0 equal to 6.28 ± 0.02A, 6.599 ± 0.003A, and 7.473 ± 0.004A, respectively. The Pt and Ni polonides have hexagonal structures with a_0 and C equal to 4.104 ± 0.004A and 1.366, and 3.973 ± 0.001A and 1.425, respectively. The Ag polonide has either orthorhombic or monoclinic structure. In addition, it was observed that Bi alloyed with Po while Ta, Au, Be, Fe, and Al did not react with Po under the conditions of preparation. (auth)

1430 MLM-808

Mound Lab., Miamisburg, Ohio

A REDETERMINATION OF THE LATTICE PARAMETERS OF POLONIUM. J. M. Goode. Jan. 30, 1953. Decl. Nov. 16, 1955. 7p. Contract AT-33-1-gen-53.

A more precise determination of the lattice parameters and x-ray density of Po has been made with the use of the extrapolation method of Bradley and Jay. The low-temperature simple cubic phase has a lattice parameter of a_0 = 3.359 ± 0.002A and an x-ray density of 9.196 ± 0.006 gram per cubic centimeter at 39°C. The high-temperature rhombohedral phase has lattice parameters of a_0 = 3.366 ± 0.002A, α = 98°5′ ± 2′, and an x-ray density of 9.398 ± 0.006 gram per cubic centimeter at 39°C. (auth)

1431 AEC-tr-2335

STATES OF DISORDER AND TRANSPORT PROCESSES IN IONIC CRYSTALS. K. Hauffe and B. Ilschner. Translated from Z. Elektrochem. 58, 466-7(1954). 19p. Available from Associated Technical Services (Trans. No. 94G7G), East Orange, N. J.

Some properties of states of disorder in ionic crystals are discussed with emphasis on their fixation at the interfaces. The transport phenomena in ionic crystals which occur whenever a state of disorder is observed were studied. (J.E.D.)

1432 AERE-Lib/Trans-489

ON THE THEORY OF NICKEL–ARSENIDE STRUCTURES. V. A. Zhdanov and M. S. Tskhai. Translated by J. B. Sykes from Zhur. Fiz. Khim. 28, 688-91(1954). 5p.

An investigation was made of the extent the structures of a homologous series can be realized when the interaction of the particles in a crystal lattice follows central force law, assuming that the energy of interaction of the particles in the lattice can be expressed as a two-term radial function. (auth)

1433 AERE-Lib/Trans-547

ON THE EXCHANGE INTERACTION OF VALENCY AND INNER ELECTRONS IN CRYSTALS [THE (s–d) EXCHANGE MODEL OF THE TRANSITION METALS]. S. V. Vonsovskii and E. A. Turov. Translated by J. B. Sykes from Zhur. Eksptl'. i Teoret. Fiz. 24, 419-28(1953). 12p.

On the basis of a multi-electron theory of transition metals, the (s–d) exchange model is constructed; this takes account of the active participation, in the physicochemical properties of crystals of transition group elements, of former valency and inner electrons from incomplete layers of the envelopes of the isolated atoms of these elements. An expression is obtained for the energy operator of the system in the second quantization representation. The eigenvalues of this operator give two branches of the energy spectrum of the system, corresponding to elementary excitations of the Bose type (ferromagnons) and of the Fermi type (conduction electrons). A nondiagonal addition to the energy operator describes the processes of interaction (collisions) between the ferromagnons and the conduction elements. (auth)

1434 AERE-Lib/Trans-564

RELATIONS BETWEEN THE PARTICLE SIZE AND ENERGY CONTENT OF MAGNESIUM OXIDE. W. Weissenbach. Translated by F. Hudswell from Radex Rundschau, No. 6, 257-60(1951). 9p.

The lattice energy of MgO (periclase) has been investigated as a function of the particle size. It is shown that there is a correlation of the activity of caustic burnt magnesite up to 4.1 kcal/mole, with the particle size of 1.10^{-6} cm. The energy plot which has been found shows why no more active samples could be prepared. (auth)

1435

THERMAL VIBRATIONS OF ATOMS IN CUBIC CRYSTALS. I. THE TEMPERATURE VARIATION OF THERMAL DIFFUSE SCATTERING OF X-RAYS BY LEAD SINGLE CRYSTALS. L. Cartz (Univ. Coll., London). Proc. Phys. Soc. (London) B68, 951-6(1955) Nov. 1.

The intensity of thermal diffuse scattering of x rays, which normally increases with rise of temperature, is expected to decrease with temperature increase for scattering near to high order reciprocal lattice points for crystals of low Debye characteristic temperature. Observations on lead single crystals agree well with theory. This decrease of diffuse scattering occurs when short thermal wavelengths are becoming predominant in the lattice, and so should be related to the melting point. A relationship between the Debye characteristic temperature and the melting point is obtained which has also been derived by Lindemann from other considerations. (auth)

1436

THERMAL VIBRATIONS OF ATOMS IN CUBIC CRYSTALS. II. THE AMPLITUDE OF ATOMIC VIBRATIONS. L. Cartz (Univ. Coll., London). Proc. Phys. Soc. (London) B68, 957-67(1955) Nov. 1.

The Lindemann relationship between the Debye characteristic temperature and the melting point may also be obtained from a consideration of the temperature variation of thermal diffuse x-ray scattering. The amplitude of thermal vibrations of the atoms in cubic crystals can be expressed in terms of the distance between neighboring atomic positions and the melting point. This leads to a correlation of the relative increases of disorder on melting of body-centered cubic and face-centered cubic crystals with the thermal behavior of the elastic constants, electrical resistance, atomic diffusion, specific heat, thermal expansion and thermal conductivity. A 'law of corresponding states' may be said to exist where, at corresponding temperatures, the amplitudes of atomic vibration are the same fraction of the distance between neighboring atomic positions in the solid. The Debye temperature factor is found to be inversely proportional to the melting point for cubic structures. (auth)

Refer also to abstracts 1383, 1384, 1637, 1639, 1643, 1644, 1646, 1647, and 1649.

ELECTRICAL DISCHARGE

1437

INTERACTION OF ELECTROMAGNETIC WAVES OF RADIO-FREQUENCY IN ISOTHERMAL PLASMAS: COLLISION CROSS SECTION OF HELIUM ATOMS AND IONS FOR ELECTRONS. J. M. Anderson and L. Goldstein (Univ. of Illinois, Urbana). Phys. Rev. 100, 1037-46(1955) Nov. 15.

The elements of the theory of interaction of radio-frequency electromagnetic waves in gaseous discharge plasmas are reviewed. The applicability of this phenomenon of wave interaction to the measurement of quantities involved in fundamental processes in such plasmas is considered. A measurement of the "effective" electron-atom collision frequency in helium, found to be 3.12×10^8/sec/mm Hg for room temperature electrons (~300°K), gives a value for the probability of collision for momentum transfer, P_m, of the helium atom equal to 24.0 cm^2/cm^3 at 0°C and 1 mm Hg. An experimental determination of the "effective" electron-ion collision frequency (for singly charged ions) has also been determined which closely agrees with earlier theoretical predictions. The ratio of the effective cross sections, associated with electron collisions, of ions and helium atoms in the room temperature isothermal plasma is $\sim 3.0 \times 10^5$ at an ion density of $10^{11}/cm^3$. (auth)

ELECTRONS

1438 AECU-3102

RAND Corp., Santa Monica, Calif.

EFFECT OF CORRELATIONS ON THE EQUATION OF STATE OF AN ELECTRON GAS. Richard Ferrell. Jan. 14, 1955. 8p. For Univ. of Calif. Radiation Lab. Contract [W-7405-eng-48], Sub-contract SC-64. (RM-1412-AEC)

Equations are presented for the calculation of the correlation factor, γ, for the exchange energy term in the equation of state of an electron gas in the Thomas-Fermi-Dirac statistical model. (C.W.H.)

1439

MEASUREMENT OF THE HIGH-ENERGY END OF THE BREMSSTRAHLUNG SPECTRUM. Donald C. Hagerman and K. M. Crowe (Stanford Univ., Calif.). Phys. Rev. 100, 869-73(1955) Nov. 1.

Results of a differential measurement of the upper six % of the bremsstrahlung photon spectrum produced by 500 ± 25 Mev electrons agree with the Bethe-Heitler formula within the combined experimental errors of approximately 25%. The measurement was made by running a collimated beam of 10^3 electrons per pulse through a diffusion cloud chamber and observing the electrons degraded in energy by the production of a gamma ray. Observation of electron-electron scattering events provided a normalization in the center of the energy region investigated. A total of 330 events was observed. The performance of a diffusion cloud chamber under these conditions is discussed. (auth)

1440

COULOMB SCATTERING OF ELECTRONS AT VERY SMALL ANGLES. Michael J. Moravcsik (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 100, 1009-12(1955) Nov. 15.

Electrostatic scattering of highly relativistic electrons at very small angles is discussed. The Hartree wave function is used to calculate the screening effects for the smallest angles. The calculations are facilitated by a theorem which states that, in the Born approximation for elastic scattering by any physical central potential, the total cross section in the relativistic limit is independent of energy. Both the "elastic" (nuclear) and "inelastic" (electronic) contributions to the scattering are investigated. It is found that at very small angles the inelastic differential cross section exceeds by many times the elastic differential cross section. Numerical calculations were carried out for scattering by nitrogen atoms, where the total cross section of the scattering by atomic electrons is 3.6 times the total cross section due to screened nuclear scattering. (auth)

1441

TRANSMISSION OF POSITRONS AND ELECTRONS. H. H. Seliger (National Bureau of Standards, Washington, D. C.). Phys. Rev. 100, 1029-37(1955) Nov. 15.

The transmissions of monoenergetic beams of positrons and electrons with energies up to 960 kev have been meas-

ured in aluminum, brass, silver, tin, lead, and gold. The absorber forms the window of a 2π counter whose counting efficiency is better than 99% down to a few hundred electron volts. Particles from a radioactive source, focused into a beam by a 90-degree magnetic analyzer impinge perpendicularly on the absorber window of the 2π counter. The total transmission is therefore measured independently of forward angle of emergence or of partial energy loss. Positrons are found to be transmitted to a greater extent than electrons except at low energies in aluminum. These results are correlated with previous backscattering experiments and are in qualitative agreement with theoretical calculations of Rohrlich and Carlson. The shapes of the transmission curves are compared semiquantitatively with predictions of the Spencer theory of electron penetration. (auth)

1442

MEAN FREE PATH FOR DISCRETE ELECTRON ENERGY LOSSES IN METALLIC FOILS. A. W. Blackstock, R. H. Ritchie, and R. D. Birkhoff (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 1078-83(1955) Nov. 15.

The discrete energy losses observed when a beam of electrons passes through a thin foil have been studied as a function of incident energy. Foils of Al, Mg, and Cu ranging in thickness from 14 to 85 $\mu g/cm^2$ have been bombarded with electrons of energies 25 to 115 kev. Losses appear at multiples of 14.9 ev and 10.7 ev respectively for Al and Mg whereas only one loss is found in Cu at 22.6 ev. Mean free paths for the losses lie in the range 25 ± 10 $\mu g/cm^2$, 165 ± 55 $\mu g/cm^2$, and $90 \pm \mu g/cm^2$ for the three metals. The magnitudes of the losses agree with the plasma oscillation theory of Pines and Bohm for Al and Mg if the number of free electrons per atom is chosen about equal to the valence. In addition the mean free path as a function of energy for Al agrees closely with the theoretical curve. (auth)

1443

ENERGY LOSS OF FAST ELECTRONS. AN INVESTIGATION INTO THE ABSOLUTE TOTAL CROSS-SECTION FOR BREMSSTRAHLUNG IN NUCLEAR RESEARCH EMULSIONS. A. G. Ekspong. Arkiv Fysik 9, No. 6, 531-53(1955). (In English)

High-energy electron tracks in nuclear emulsions may be used to explain the nature of electron energy loss. This technique is explained and applied in obtaining a value of the total cross section for Bremsstrahlung. (D.E.B.)

Refer also to abstract 1423.

GASES

1444 AEC-tr-2351

MAGNETIC ANALYSIS OF A BEAM OF POSITIVE IONS ACCELERATED BY A VOLTAGE OF 5 TO 30 KV AFTER PASSAGE THROUGH A RAREFIED GAS. N. V. Fedorenko. Translated from Zhur. Tekh. Fiz. 24, 769-83(1954). 15p. Available from Associated Technical Services (Trans. 94G6R), East Orange, N. J.

An ion beam monochromatic both in composition and energy was transmitted through a gas and analyzed by a magnetic field. Beams were investigated which initially consisted of atomic ions: singly charged (He^+, N^+, Ne^+, K^+, A^+, Ca^+, I^+, Ba^+, Pb^+, Bi^+), doubly charged (N^{++}, A^{++}, Ba^{++}), triply charged (A^{+++}), and singly charged molecular ions (H_2^+, H_3^+, N_2^+). An examination was made as to which inelastic processes, connected with a change in the e/m of the ions in the beam, take place in single binary collisions between the ions and atoms of helium, neon, argon, krypton, and molecules of hydrogen and nitrogen. For singly charged atomic ions the existence has been established of the process of removal of one electron from the ionic shell (ion stripping). The cross section for this process is larger for ions of the heavy elements (for the process $Ba^+ \rightarrow Ba^{++}$ the cross sections sometimes exceed 10^{-16} cm.^{2}). The processes $Ba^+ \rightarrow Ba^{+++}$ and $Ba^{++} \rightarrow Ba^{+++}$ have also been discovered. Electron capture by doubly and triply charged ions was investigated. For the A^{+++} ions the existence of two competing processes has been established: $A^{+++} \rightarrow A^{++}$ and $A^{+++} \rightarrow A^+$. The capture cross sections vary within the limits 1×10^{-16} to 2.5×10^{-15} cm.^{2} An estimate has been made of the effective dissociation cross sections for the ions H_2^+, H_3^+, N_2^+. (auth)

1445

EQUATION OF STATE OF GASES BY SHOCK WAVE MEASUREMENTS. I. EXPERIMENTAL METHOD AND THE HUGONIOT OF ARGON. Russell H. Christian and Frederick L. Yarger (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 23, 2042-4(1955) Nov.

An experimental method is described for the simultaneous measurement of the velocity of a plane shock through a gas and the associated particle velocity. Shocks are generated by a plate driven by a high-explosive system. The velocities are recorded by a high-speed rotating-mirror smear camera with a precision of about $\pm \frac{1}{2}\%$. Data are presented defining the Hugoniot of argon between 200 and 1100 Los Alamos atmospheres. These data are compared with the theoretically predicted Hugoniot. (auth)

INSTRUMENTS

1446 HW-38991

Hanford Atomic Products Operation, Richland, Wash.
AN APPARATUS FOR OBTAINING THE TENSILE PROPERTIES OF IRRADIATED MATERIALS AT ELEVATED TEMPERATURES. R. E. Hueschen and D. C. Kaulitz. Sept. 14, 1955. 22p. Contract W-31-109-Eng-52.

A tensile testing unit is described which permits the testing of highly-radioactive specimens at temperatures up to 800°C(1475°F). The vacuum tensile furnace, mounted on a 60,000 lb Baldwin tensile machine, is constructed to permit the measurement of elongation by a newly developed optical instrument. Tensile elongation measurements of 50% with one-inch gage length specimens makes the unit a relatively long range extensometer. (auth)

1447 UCRL-3084

California. Univ., Berkeley. Radiation Lab.
A MAGNETOMETER FOR MEASURING FIELDS TO 300 GAUSS. Ferdinand Voelker and Minard A. Leavitt. July 1955. 8p. Contract W-7405-eng-48.

This instrument was developed for measurement of magnetic field in an electron cyclotron where the following requirements were to be met: accuracy of 0.1% to fields of 100 gauss; continuous monitoring of magnetic field to allow automatic plotting of field versus position of the probe; and, quadrupole probe construction, minimizing the effect of near-by iron on the measurements. Two newer versions of the probe have been built, one for measurement of the earth's field which sacrifices field range above

10 gauss for small size and the other for fields to 300 gauss which sacrifices quadrupole construction. (auth)

1448 UCRL-3154

California. Univ., Berkeley. Radiation Lab.

A CAVITY-STABILIZED OSCILLATOR WITH TWO FEEDBACK CIRCUITS (thesis). Jack Vernon Franck. Sept. 28, 1955. 80p. Contract W-7405-eng-48.

The pre-exciter oscillator used on the Berkeley 32-Mev proton linear accelerator is studied analytically and experimentally. The oscillator operates on 202.55 Mc using a single power tetrode, and is equivalent to a two-stage amplifier with two feedback circuits. Feedback circuit number one is a broadly tuned circuit around the first stage. Feedback circuit number two is a sharply tuned circuit around both stages. Feedback circuit No. 2 includes the cavity resonator. The object is a reduction in the number of high-frequency power tubes required in a conventional system. The frequency bandwidth over which the oscillator will "pull" to the resonator frequency is calculated and is found to be in good agreement with the measured value. Graphical calculators have been devised and used to reduce the computation to a minimum. The analysis of a self-oscillating system with two feedback circuits is believed to be new. (auth)

1449

THEORETICAL BASIS FOR LIGHT-AMPLIFYING PHOSPHORS. Ferd E. Williams (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 98, 547-8(1955) Apr. 15.

The impact excitation mechanism of radiation amplification in a phosphor is discussed. (C.W.H.)

1450

ON THE PULSE HEIGHT ANALYZER OF HUTCHINSON AND SCARROT. F. E. L. Ten Haaf. Ned. Tijdschr. Natuurk. 21, 231-8(1955) Sept. (In Dutch)

1451

EXPERIMENTS ON THE DEPENDENCE OF SENSITIVITY ON VELOCITY PROFILE IN ELECTROMAGNETIC FLOWMETERS. J. A. Shercliff (Univ. of Cambridge, England). J. Sci. Instr. 32, 441-2(1955) Nov.

Mercury was passed along a non-conducting circular tube bearing flowmeter-type electrodes situated in a transverse magnetic field downstream of a small offset orifice. When the flow was concentrated near the electrodes the ratio of induced potential difference to the product of magnetic field and flow rate was found to reach more than twice the value appropriate to axially symmetric velocity profiles. When the flow was concentrated at the side of the tube this ratio could fall to zero and even change sign. Further downstream a steady state was reached, sometimes in a oscillatory manner. (auth)

ISOTOPE SEPARATION

1452 ORNL-196

Oak Ridge National Lab., Tenn.

THE PREPARATION OF CARRIER-FREE RADIOBERYLLIUM OBTAINED FROM LITHIUM. Rene A. Bolomey and A. Broido. Dec. 9, 1948. Decl. July 28, 1954. 11p. Contract W-7405-eng-26.

Carrier-free Be^7, in about 96% yield, has been successfully separated and purified by means of acetyl acetone from a Li target bombarded with deuterons in the Berkeley cyclotron. The bulk of the impurity was Ca, Fe, and Mg. These elements were found to come from the reagents employed in the separation procedure. (auth)

Refer also to abstracts 1293 and 1455.

MASS SPECTROGRAPHY

1453 IDO-14336

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

AN IMPROVED THERMAL EMISSION MASS SPECTROMETER FOR PRODUCTION CONTROL. M. W. Echo and T. D. Morgan. May 16, 1955. 25p. Contract AT(10-1)-205.

Improvements in the design and fabrication techniques of a thermal emission mass spectrometer constructed at the National Reactor Testing Station are described. The design is based on a 12 in. radius, 60° type mass spectrometer developed for use in analyzing solid samples. The instrument includes a vacuum lock similar to that developed at ANL with improvements based on experience at the Idaho Chemical Processing Plant. (auth)

1454 KAPL-1422

Knolls Atomic Power Lab., Schenectady, N. Y.

THE ION RESONANCE MASS SPECTROMETER AS AN ANALYTICAL INSTRUMENT. C. F. Pachucki, L. R. Yetter, and H. C. Mattraw. Nov. 15, 1955. 31p. Contract W-31-109-Eng-52.

The General Electric ion resonance mass spectrometer utilizes the resonant frequency of ions in its operation. Gases are ionized and then accelerated and separated using an r-f voltage in a constant magnetic field. Variation of the r-f voltage facilitates the scanning of a mass spectrum. The basic instrument and the alterations and additions to it are described. Performance data are given showing satisfactory results where various mixtures of gases such as H_2, D_2, He, CH_4, N_2, CO, A and CO_2 have been analyzed. D_2 and He resolution is complete. Appearance potentials of various gases as determined with the ion resonance mass spectrometer are given. (auth)

1455 NP-5833

Brigham Young Univ., Provo, Utah.

MEASUREMENT OF MASSES AND RELATIVE ABUNDANCES OF NUCLEAR SPECIES BY CYCLOTRON RESONANCE. Technical Report No. 2. A METHOD FOR ELIMINATING ERROR DUE TO RADIAL FIELDS AND FOR DIRECT MEASUREMENT OF MASS RATIOS IN THE OMEGATRON. Hugh J. Woodford and John H. Gardner. Oct. 31, 1955. 12p. Project No 5 B99-10-004. Contract DA-04-495-Ord-518.

An omegatron having two pair of ion accelerating plates instead of one and using resonance absorbtion detection has been used successfully to obtain simultaneous cyclotron resonances of two different ion species in the same field. When used in conjunction with a nuclear resonance probe, the method effectively eliminates errors due to perturbing radial electric fields in the omegatron; alternatively, if radial electric fields are considered negligible, the method permits the direct measurement of mass ratios. (auth)

1456
STABILIZATION OF ION SOURCE TEMPERATURE IN MASS-SPECTROMETERS MC-1 AND MC-2. G. D. Tantsyrev, L. L. Dekabrun, V. L. Tal'pose. Zhur. Tekh. Phys. 25, 1983-7(1955) Nov. (In Russian)

A system for temperature stabilization of the ion source of Nier type was developed. The scheme and diagrams are presented. (R.V.J.)

1457
THE STATUS OF PRECISE MASS SPECTROGRAPHY. J. Kistemaker. Ned. Tijdschr. Natuurk. 21, 219-29(1955) Sept. (In Dutch)

MATHEMATICS

1458 CERN-PS/RH 9
[European Council For Nuclear Research, Geneva].
STABILITY OF TWO-DIMENSIONAL NON-LINEAR OSCILLATIONS WITH PERIODICAL HAMILTONIAN; APPLIED TO THE NON-LINEAR BETATRON OSCILLATIONS OF AN ALTERNATING-GRADIENT SYNCHROTRON. R. Hagedorn. Nov. 1955. 74p.

1459 ORNL-1892
Oak Ridge National Lab., Tenn.
ON THE FUNDAMENTAL EIGENVALUE OF A SOLID. Herbert Goertzel. June 24, 1955. 77p. Contract W-7405-eng-26.

Properties of Steiner symmetrization and the fundamental eigenvalue of a solid are developed. Numerical results of specific problems are given. (B.J.H.)

1460 AEC-tr-2350
THE METHOD OF MATCHING MAXIMA. E. P. Novodvorskii and I. Sh. Pinksker. Translated from Uspekhi Matemat. Nauk 6, 174-81(1951). 9p. Available from Associated Technical Services (Trans. 27G7R), East Orange, N. J.

A discussion is given on the problem of choosing from a well defined set of functions that one function which differs least from a given function. (B.J.H.)

1461
REDUCTION OF POTENTIAL ENERGY ON WAVE SCATTERING PHASES. V. A. Marchenko (Skovoroda State Pedagogical Inst. Khar'kov.) Doklady Akad. Nauk S.S.S.R. 104, 695-8(1955) Oct. 11. (In Russian)

Refer also to abstract 1628.

MEASURING INSTRUMENTS AND TECHNIQUES

1462 AWRE-O-20/55
Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
A FACTOR AFFECTING BETA-COUNTING WITH G. M. TUBES. J. Weaver and F. Morgan. June 13, 1955. 15p.

Potential sources of error in counting β particles with end-window Geiger-Mueller tubes were investigated. Nonconducting windows caused count variations as high as 20%. Variations were found to be related to humidity. Application of a deliquescent salt or spraying the window with graphite improved the stability of the counting system and counting reproducibility. (C.H.)

1463 BNL-2229
Brookhaven National Lab., Upton, N. Y.
A TECHNIQUE FOR THE PRODUCTION OF SELF-SUPPORTING GOLD FILMS. A. I. Weinstein. [1955?]. 2p.

1464 NARF-55-77T
Consolidated Vultee Aircraft Corp., Fort Worth, Tex.
CALIBRATION OF ANTHRACENE DOSIMETERS. F. W. Smith and F. N. Mortensen. Nov. 21, 1955. 34p. Contract AF33(038)-21117. (MR-N-30)

A type of anthracene scintillation detector was investigated in connection with the development of γ dosimeters. It was found to be sensitive in the range between 0.2 mr/hr to 20 r/hr, easily calibrated, and quite stable in response. The effects of temperature, angular response, and voltage stability were determined. (auth)

1465 NP-5823
Canada. Dept. of Mines and Technical Surveys. Mines Branch.
A COMPACT TRANSISTORIZED MONITOR FOR RADIOACTIVE ORE. G. E. Alexander and G. G. Eichholz. Sept. 29, 1955. 12p. (TR-132/55)

A transistorized monitor unit is described which was designed to facilitate the hand picking of high grade ore pieces from mine ore passing on a conveyor belt. Simplicity of operation and long term reliability were the main considerations in the design of the unit. Details of operational procedure and maintenance are also given. (auth)

1466 ORNL-1929
Oak Ridge National Lab., Tenn.
ELECTRONIC INSTRUMENTATION FOR A MULTIPLE-CRYSTAL GAMMA-RAY SCINTILLATION SPECTROMETER. T. A. Love, R. W. Peele, and F. C. Maienschein. Oct. 25, 1955. 31p. Contract W-7405-eng-26.

Complete circuit diagrams are given for the multiple-crystal γ-ray spectrometer to be used at the Bulk Shielding Facility. Results of measurements of resolution of the electronic equipment are also shown. (B.J.H.)

1467 UCRL-3094
California. Univ., Berkeley. Radiation Lab.
AN ELECTROSTATIC BETA-RAY SPECTROMETER WITH A DOUBLE RETARDING FIELD (thesis). Herbert Raymond Johnston. Oct. 26, 1955. 112p. Contract W-7405-eng-48.

A novel type of beta-ray spectrometer is described. It uses two retarding electrostatic fields of slightly different magnitudes to distinguish between beta particles of different energies, and a secondary electron multiplier as a detector. The nominal beta energy range of the machine as constructed is from 1 to 50 kev. The mathematical theory of the spectrometer is given. Calculated solid-angle transmission is of the order of 0.14% of 4π and the resolution can be varied from 0.5 to 2.0% (on an energy basis) by varying the potentials of the electrodes. It is about equal in transmission and somewhat superior in resolution to the flat magnetic spectrometer. It is especially useful in the lower energy ranges that cannot be measured with magnetic spectrometers, which usually employ thin-window G-M counters as detectors, since their magnetic field would interfere with the operation of an electron multiplier. The results of testing the spectrometer with a monokinetic source of electrons are given. These tests confirm the predictions made from

theoretical considerations within the approximations involved. The radioactive sample used to test the machine was an organic compound of tritium. The results were consistent with the known characteristics of the tritium spectrum. (auth)

1468 UCRL-3179

California. Univ., Berkeley. Radiation Lab.
CASTING ASTROLITE CYLINDERS. Larry Oswald. Oct. 28, 1955. 3p. Contract W-7405-eng-48.

Casting of alcohol-resistant Astrolite cylinders for the experiments in cloud chambers of the 184-inch cyclotron and the Bevatron is described. (R.V.J.)

1469

SCINTILLATION COUNTER FOR DETECTION OF X-RAYS. J. T. Nelson and R. T. Ellickson (Univ. of Oregon, Eugene). J. Opt. Soc. Amer. 45, 984-6(1955) Nov.

A scintillation counter using NaI(Tl) is described. The sensitivity is such that the yield of photoelectrons is about 3.5 per 1000 ev x-ray energy. The response is linear over a range in intensity of 5×10^5. (auth)

1470

PHOTOGRAPHIC EFFECT OF COUNTER DISCHARGES. K. S. Lion and G. F. Vanderschmidt (Massachusetts Inst. of Tech., Cambridge). J. Opt. Soc. Amer. 45, 1024-7(1955) Dec.

Gas discharges in point or parallel plate counters can produce a blackening effect on photographic emulsion layers inserted in such counters. The discharges are localized to points where ionizing radiation enters the counter. Arrangements of this type can be used for image intensifiers. A description of the operation of such counters and a proposed interpretation as to the physical mechanisms involved are presented. (auth)

1471

ABSOLUTE SCINTILLATION EFFICIENCY OF ANTHRACENE CRYSTALS. G. T. Wright (Rhodes Univ., Grahamstown, South Africa). Proc. Phys. Soc. (London) B68, 929-37(1955) Nov. 1.

The absolute scintillation efficiency of anthracene crystals excited with fast electrons is measured. The experimental method used avoids the errors existing in previous measurements which are due to the anisotropic refraction, spatial distribution, and reabsorption of fluorescence in these crystals. At a temperature of 290°K, the intrinsic scintillation efficiency (in the absence of reabsorption of fluorescence) is found to be 0.062 ± 0.004; this is reduced to 0.050 ± 0.005 for the crystal by self-absorption of fluorescence. Reasons for this low efficiency are discussed. A detailed description is given of excitation conditions produced in organic crystals by ionizing particles with a discussion of possible quenching mechanisms in the excitation column. For electrons, these are considered to be due to internal molecular dissipation of electronic excitation energy, to mutual interaction between excited molecules, and to the strong electric fields surrounding ions. For the heavy particles, these processes are more pronounced, and further quenching occurs due to thermal fields and to damaged molecules. The role of migration of excitation energy is also considered. This description of the scintillation process satisfactorily explains the low efficiencies and the decay shapes of fluorescence observed experimentally. (auth)

1472

A THEORY OF CAVITY IONIZATION. L. V. Spencer and F. H. Attix (National Bureau of Standards, Washington, D. C.). Radiation Research 3, 239-54(1955) Nov.

A theory of cavity ionization is presented which takes into account the travel of fast secondary electrons generated in electron-electron collisions, an effect disregarded in the Bragg-Gray theory. The problem is schematized by defining as fast secondaries those with energy above a threshold Δ sufficient to span the cavity. Calculations based on this theory show closer agreement with experiments of Attix and DeLaVergne than Bragg-Gray theory calculations. The theories differ most when the wall and gas atomic numbers are very different. The dependence of ionization on the cavity size predicted by the present theory agrees with measurements by Gray. The interpretation of extrapolation to zero cavity size is shown to be more complex than had been believed. (auth)

1473

ON THE ANALYSIS OF $Co^{60}-Fe^{59}$ MIXTURES BY A COINCIDENCE TECHNIQUE. Erik Odeblad, Leo Meurman, and Donato Ziliotto. Acta Radiol. 44, 337-44(1955) Oct.

Single crystal coincidences of the cascade gamma rays from Co^{60} enable the analysis of $Co^{60}-Fe^{59}$ mixtures in spite of the energetically nearly identical radiations from these two radioisotopes. Some theoretical and technical aspects are presented. It is shown how the single crystal coincidence technique can be used for analysis in vitro and in vivo. (auth)

1474

CONTRIBUTION TO THE STANDARDIZATION OF RADIOELEMENTS. PRECISE MEASUREMENTS OF RADIOACTIVE HALF LIVES. Jacques Tobailem. Ann. phys. 10, 783-829(1955) Sept.-Oct. (In French)

The problem of the precise measurement of radioactive half lives was approached by a differential ionization technique using an electrometer tube. By this method, it is possible to obtain rapid and precise measurements. The experimental apparatus is described in detail. Radioactive half lives from several hours to a number of years were measured accurately by this method. (B.J.H.)

1475

QUANTITATIVE BETA TRACK AUTORADIOGRAPHY WITH NUCLEAR TRACK EMULSIONS. Hilde Levi and Anne S. Hogben. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 30, No. 9, 1955. 23p.

The applicability of the nuclear track plate NTB-2 (of Eastman Kodak, Rochester, N. Y.) to quantitative beta tract autoradiography has been investigated. A constant source of C^{14} beta particles was brought in contact with the emulsion and the number of tracks registered per unit area of the plate was counted. The counting results obtained by four different investigators evaluating a total of 50 images were subjected to statistical analysis. The reproducibility of the track count was studied, both with respect to the counting ability of one and the same investigator repeatedly confronted with a given track pattern, and to the evaluation of the same pattern by different investigators. A statistical analysis of the counting results permits one to estimate the homogeneity of the emulsion in small areas of the plates, to compare the homogeneity of plates from the same batch, and their sensitivity from batch to batch. The efficiency of the

plates and the effect of storage conditions have likewise been investigated. The contributions of various sources of error to the uncertainty of the final counting results were estimated. (auth)

1476

SCINTILLATOR GRID LOCALIZES GAMMA EMITTERS PHOTOGRAPHICALLY. C. Kellershohn and P. Pellerin (Faculte de Medecine, Nancy, France). Nucleonics 13, No. 12, 34-7(1955) Dec.

A system of NaI crystals set in a lead collimating grid has been designed which permits the "in vivo" localization of a radioactive body. Some of its principal applications are discussed. Results of tests indicate that the image obtained gives a satisfactory picture of the object. (B.J.H.)

1477

PULSE HEIGHT COMPARISON OF PRIMARY SOLUTES. F. Newton Hayes, Donald G. Ott, Vernon N. Kerr, and Betty S. Rogers (Univ. of Calif., Los Alamos, New Mexico). Nucleonics 13, No. 12, 38-41(1955) Dec.

The scintillation properties of 102 organic compounds in toluene as a solvent are given. In particular, the maximum pulse heights obtained with each scintillator are tabulated. (B.J.H.)

1478

HIGH-DOSE MEASUREMENT BY OPTICAL ABSORPTION. J. F. Fowler and M. J. Day (Royal Victoria Infirmary, Newcastle, England). Nucleonics 13, No. 12, 52-3(1955) Dec.

It is suggested that the change produced in the optical absorption of polymethyl methacrylate or polystyrene may be useful in the measurement of high doses of ionizing radiation. Results show that the increase of optical absorption with dose is linear to about 2×10^7 r. (B.J.H.)

1479

HOW TO MEASURE BETA ACTIVITY OF FISSION PARTICLES USING FILM. Clarence Skillern (Univ. of Calif., Los Alamos, New Mexico). Nucleonics 13, No. 12, 54-6(1955) Dec.

A radioautographic method of using x-ray and photographic films to measure the beta activity of particles containing fission products is described. Measurements are limited to activity from isolated point sources. Results for various types of x-ray film are shown. (B.J.H.)

1480

DESIGN FOR A SENSITIVE SELF-RECORDING GOLD-LEAF ELECTROSCOPE. P. Goodman (Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia). J. Sci. Instr. 32, 439-40(1955) Nov.

The principle of operation and construction of a gold-leaf electroscope, capable with calibration of measuring steady electron currents of the order 10^{-14} amp is described. The output is in the form of voltage pulses, the frequency of which is proportional to current for low values, and logarithmically related for higher currents. (auth)

Refer also to abstracts 1217 and 1513.

MESONS

1481

INTRODUCTION TO SOME RECENT WORK IN MESON THEORY. G. C. Wick (Carnegie Inst. of Tech., Pittsburgh). Revs. Mod. Phys. 27, 339-62(1955) Oct.

Material from lectures at the Carnegie Institute of Tech., and correspondence with recognized authorities on recent developments in meson theory are combined to give a quantitative statement of meson phenomena. (D.E.B.)

1482

THE SCATTERING OF μ-MESONS IN LEAD AND IRON. J. L. Lloyd and A. W. Wolfendale (Univ. of Manchester, England). Proc. Phys. Soc. (London) A68, 1045-65(1955) Nov. 1.

A description is given of a cloud chamber experiment in which the dependence of the multiple and large-angle scattering of μ mesons on momentum, sign, and atomic number is investigated. The results are compared with Molière's theory for a point nucleus, Olbert's theory for an extended nucleus, and a more accurate modification of Olbert's theory. These theories give an adequate description of the multiple scattering for small momentum transfers. For large momentum transfers, where the size and structure of the nucleus should profoundly modify the scattering, Molière's theory is found to give a better description than Olbert's theory. (auth)

1483

SOME STUDIES ON HEAVY MESON EVENTS IN STRIPPED EMULSIONS. J. K. Bøggild, J. E. Hooper, W. C. G. Ortel, and M. Scharff. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 30, No. 3, 1955. 28p.

An account is given of 17 K-meson events found in half a stack of stripped emulsions exposed during the Sardinia expedition of 1953. Evidence is presented for the mode of decay $K\mu \rightarrow \mu + \nu$, where the μ meson is emitted with $\rho\beta c = (224 \pm 7)$ Mev, and the best mass of the $K\mu$ meson is $(990 \pm 16)\ m_e$. An example of χ decay is also reported and discussed. (auth)

1484

MESONIC X-RAYS FROM CAPTURE OF COSMIC-RAY μ MESONS IN A CHEMICAL COMPOUND. A. Fafarman and M. H. Shamos (New York Univ., N. Y.). Phys. Rev. 100, 874-9(1955) Nov. 1.

Measurements have been made of the x rays emitted by mesonic carbon and oxygen atoms formed by the capture of negative cosmic ray μ mesons. A 4-liter tank of liquid scintillator, dioxane, $C_4O_2H_8$ (plus 10 g/l of p-terphenyl) served as the absorber and as the detector for the stopping of cosmic-ray μ mesons. The mesons were identified by the method of delayed coincidences. The mesonic x-rays from the dioxane were detected by a scintillation spectrometer. Spectrometer pulses in coincidence with the stopping meson were lengthened and their pulse height recorded on a recording milliammeter. The time distribution of the delayed coincidences was recorded over the delay interval 0.5 to 8.0 μsec. The measured $2p-1s$ transition energies of 82 kev and 145 kev, for carbon and oxygen respectively, agree with the simple Bohr orbit calculations within the precision of the measurement. The observed ratio of captures by oxygen and carbon (0.33 ± 0.04) does not agree with the Z-dependence predicted by Fermi and Teller for mesonic atom formation by chemical compounds (0.67) nor with the simple stopping power calculation (0.50); however, in view of the thick absorber (14 cm depth of dioxane), the above experimental ratio is uncertain because of Compton degradation of the oxygen $2p-1s$ radiation which shifts some events from the oxygen to the carbon peak. The observed distribution of delays is consistent with the assignment of the observed radiation to μ-meson capture. (auth)

1485

ANGULAR CORRELATION EFFECTS IN V-PARTICLE DECAY. S. B. Treiman and H. W. Wyld, Jr. (Princeton Univ., N. J.). Phys. Rev. 100, 879-82(1955) Nov. 1.

In decay processes of the types: hyperon → nucleon + pion; or K-meson → pion + pion, the most general distribution function in η—the angle between the decay plane normal and a reference direction N normal to the line of flight of the unstable particle—has the form of a finite Fourier series. The degree of the highest harmonic is simply related to the spin of the unstable particle. The coefficients in the series depend on the state of polarization of the spin with respect to the reference direction N. It is possible, however, to set upper limits on the coefficients; this may prove useful in any attempt to analyze angular correlation data, particularly in the case of hyperon decay. The upper limits for various low spin values are computed, and other consequences of the angular momentum and parity conservation laws are discussed. (auth)

1486

LIFETIMES OF THE τ^+ AND K_L^+-MESONS. G. Harris, J. Orear, and S. Taylor (Columbia Univ., New York). Phys. Rev. 100, 932(1955) Nov. 1.

Preliminary lifetime values for the τ^+ and K_L^+ mesons were obtained by measuring the Bevatron K-beam attenuation relative to the beam pions and protons. Nuclear emulsions were used to obtain data. Results give $\tau_K = (7^{+1.5}_{-1}) \times 10^{-9}$ sec and $\tau_\tau = (8^{+5}_{-2}) \times 10^{-9}$ sec. (B.J.H.)

1487

SPECULATIONS ON HEAVY MESONS. T. D. Lee and J. Orear (Columbia Univ., New York). Phys. Rev. 100, 932-3(1955) Nov. 1.

It is suggested that there exist two heavy mesons, $\theta^\pm$ and $\tau^\pm$, where $\theta^\pm \to \pi^\pm + \pi^0$ and $\tau^\pm \to \pi^\pm + 2\pi$. All cascade possibilities are discussed. (B.J.H.)

1488

NUCLEAR INTERACTION IN FLIGHT OF A Σ HYPERON. W. F. Fry, J. Schneps, G. A. Snow, and M. S. Swami (Univ. of Wisconsin, Madison). Phys. Rev. 100, 939(1955) Nov. 1.

A projection drawing is shown of an event involving the interaction of a charged hyperon in flight, and the stars produced are discussed. The event is interpreted to be an inelastic scattering of a positively charged Σ hyperon. (B.J.H.)

1489

OBSERVATIONS OF NEGATIVE K-MESONS AND CHARGED HYPERONS. W. F. Fry, J. Schneps, G. A. Snow, and M. S. Swami (Univ. of Wisconsin, Madison). Phys. Rev. 100, 950-2(1955) Nov. 1.

A summary is given of the important features of K-meson stars produced in pellicle stacks which were exposed, in a negative K-meson channel of the Bevatron, to particles from a target bombarded by 6.2-Bev protons. (B.J.H.)

Refer also to abstract 1626.

MOLECULAR PROPERTIES

1490 K-1223

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.

A SEMI-CLASSICAL TREATMENT OF THE INTERACTION OF LATTICE VIBRATIONS WITH ADSORBED MOLECULES. W. C. DeMarcus. June 21, 1955. 15p. Contract W-7405-eng-26.

The transition probabilities between states of a physically adsorbed molecules are derived from a semi-classical picture and shown to be in exact agreement with the more rigorous treatment of Lennard-Jones and Strachan, in which the whole system, solid plus adsorbed molecule, is quantized. It is felt that there is a considerable gain in simplicity as well as intuitive grasp of the processes by following this procedure. It is shown that the transition probabilities which involve the matrix elements of the gradient of the adsorption potential can be transformed to involve the oscillator strengths, a result which is believed to be novel. The limitations of the perturbation theories employed in both the present work and that of Lennard-Jones and Strachan are briefly discussed. (auth)

1491

TRANSITION TEMPERATURES OF He^3–He^4 SOLUTIONS. J. G. Dash and R. Dean Taylor (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 99, 598-9(1955) July 15.

Transition temperatures for pure He^4 and three He^4–He^3 solutions were determined. Values were: 100% He^4, 2.182 ± 0.0005°K.; 3.65 ± 0.2% He^3, 2.127 ± 0.002°K.; 6.0 ± 0.2% He^3, 2.096 ± 0.002°K.; and 9.2 ± 0.002% He^3, 2.045 ± 0.002°K. (D.E.B.)

1492

THE SELF-CONSISTENT FIELD FOR Zr^{4+}. S. L. Altmann (Mathematical Inst., Oxford). Proc. Phys. Soc. (London) A68, 987-93(1955) Nov. 1.

A fairly general program for the computation of atomic self-consistent fields without exchange has been prepared for the Manchester University electronic computer. Results obtained for the Zr^{4+} ion are given. (auth)

1493

THE MAGNETIC AND SPECTROSCOPIC PROPERTIES OF CERTAIN RARE-EARTH DOUBLE NITRATES. B. R. Judd (Univ. of Oxford, England). Proc. Roy. Soc. (London) A232, 458-74(1955) Nov. 22.

The theory that has been developed for rare-earth ions in crystals is here applied to the double nitrates. The paramagnetic resonance data and certain spectroscopic properties of the different rare-earth double nitrates, depending as they do on the crystalline electric field at a rare-earth ion, are related to the six parameters through which the field is defined. It is found that most of the experimental results can be fitted to values of the parameters that vary in a systematic fashion along the rare-earth series. (auth)

1494

REGULARITIES IN THE ABSORPTION SPECTRA OF HALIDES. Leonard I. Katzin (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 23, 2055-60(1955) Nov.

Original absorption spectra of halides and a large body of literature absorption spectrum data are assembled. Certain characteristic features are pointed out which can be ascribed to transitions of electrons localized on the halide portion of a molecule or ion, such that their removal to an excited condition essentially leaves a neutral halogen atom as part of the excited state configuration. (auth)

Refer also to abstract 1399.

NEUTRONS

1495 NAA-SR-1137(Pt.1)

North American Aviation, Inc., Downey, Calif.

ABSOLUTE THERMAL NEUTRON DETERMINATION. PART I. MEASURING THE RATIO OF THERMAL TO RESONANCE NEUTRON DENSITIES USING THICK INDIUM FOILS. Moses A. Greenfield, Roscoe L. Koontz, and Alan A. Jarrett. Dec. 1, 1955. 17p. Contract AT-11-1-Gen-8.

Measurements have been made of the cadmium ratios of indium foils for foil thicknesses ranging from 0.012 mg/cm^2 to approximately 100 mg/cm^2. Correction factors are presented both graphically and in tabular form to determine the ratio of resonance to thermal neutron densities from measurements made with an indium foil of any thickness up to 100 mg/cm^2. (auth)

1496 NDA-14-24

Nuclear Development Associates, Inc., White Plains, N. Y.

NOTES ON DOPPLER EFFECT. G. Goertzel and R. Aronson. Feb. 23, 1954. 4p.

Starting with the basic formula for the effective neutron cross section, there are derived two formulas for evaluating the change in the collision rate as a function of temperature. (auth)

1497 NDA-14-71

Nuclear Development Associates, Inc., White Plains, N. Y.

SLOWING DOWN OF NEUTRONS IN NONHYDROGENOUS MULTILAYER SHIELDS. H. Yamauchi. July 15, 1955. 91p.

An essentially analytical method for estimating neutron distributions in nonhydrogenous multilayer shields was developed for the purpose of shielding calculations. Included are discussions of the general method of solution, uncollided flux, neutron distributions near boundaries due to first collision sources, corrections for vacuum, neutron absorption in shields, and calculations for fast neutrons. Specific solutions are given in appendices. (B.J.H.)

1498 ORNL-1958

Oak Ridge National Lab., Tenn.

EFFECT OF MODERATOR TEMPERATURE UPON NEUTRON FLUX IN INFINITE, CAPTURING MEDIUM. R. R. Coveyou, R. R. Bate, and R. K. Osborn. Oct. 20, 1955. 30p. Contract W-7405-eng-26.

The integral equation governing the dependence upon speed of the neutron flux for moderation in an infinite, capturing medium has been solved by Monte Carlo methods. Effects on the flux due to the thermal motions of the scattering and absorbing atoms are taken into account within the context of the assumption that the thermal speed distributions are Maxwell-Boltzmann in character. Results for several different scattering masses and several different $(1/v)$-absorption cross sections are presented in detail. (auth)

1499

THEORY OF NEUTRON REACTIONS WITH NUCLEI AT LOW ENERGY. K. A. Brueckner, R. J. Eden, and N. C. Francis (Indiana Univ., Bloomington). Phys. Rev. 100, 891-900(1955) Nov. 1.

A theory of the interaction of low-energy neutrons with nuclei has been developed using methods previously applied to the study of the nuclear ground state. It is shown that an average potential is predicted by the theory which very closely resembles that used by Feshbach, Porter, and Weisskopf in their studies of the neutron cross sections. The calculated parameters for scattering at a few Mev are a real depth of 41 Mev and an imaginary part somewhat less than 1 Mev. The theory also predicts the appearance of characteristic narrow compound-state resonances in the cross section; these are the result of sharp fluctuations in the real and imaginary part of the equivalent potential acting on a neutron which are the result of appreciable coupling between the single-particle and compound-nucleus states. An estimate of the level width is given for a simple class of compound-state levels and is of the order of typical widths observed experimentally. A comparison of these results is made with a theory of Wigner, Lane, and Thomas; the principal difference is in the much smaller imaginary part of the potential determined by this theory. (auth)

1500

ANGULAR CORRELATION IN THE BETA DECAY OF THE NEUTRON. J. M. Robson (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 100, 933-5(1955) Nov. 1.

The electron-neutrino angular correlation coefficient was determined for the β decay of the neutron by measuring the momentum spectrum of those electrons emitted in a restricted angular range of 145 to 175° from the proton recoil direction. The apparatus plan, which is mounted at the face of the NRX reactor, is shown, as is the electron momentum spectrum. Results give the electron neutrino angular correlation coefficient at + 0.089 ± 0.108. (B.J.H.)

1501

INELASTIC SCATTERING OF NEUTRONS BY DEFORMED NUCLEI. D. M. Brink (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) A68, 994-1000(1955) Nov. 1.

The cross section for direct inelastic scattering from the nuclear surface deformation is calculated and compared with the compound nucleus inelastic cross section. It is found, using optical model wave functions, that the direct process can be important in the regions of atomic weight near A = 150 and A = 240. (auth)

1502

A HIGH VOLTAGE GENERATOR IN A PRESSURE TANK FOR NEUTRON PRODUCTION. A. C. van Dorsten and J. H. Spaa. Ned. Tijdschr. Natuurk. 21, 213-18(1955) Sept. (In Dutch)

1503

SPECTROMETRY OF SLOW NEUTRONS WITH SCINTILLATION COUNTERS. H. Nauta. Ned. Tijdschr. Natuurk. 21, 239-45(1955) Sept. (In Dutch)

1504

THE INTERACTION OF NEUTRONS WITH MATTER STUDIED WITH A PULSED NEUTRON SOURCE. G. F. von Dardel (AB Atomenergi, Stockholm). Trans. Roy. Inst. Technol. Stockholm, No. 75, 104p., 1954.

The theory of attenuation and diffusion processes for neutrons in matter is discussed in detail. The neutrons used in these experiments were produced by a D-D reaction in an accelerator target. General descriptions of all equipment are given. The energy distribution of the neutrons was studied in boron and in "Hysil" glass. Methods of measurement and the treatment of data are also considered in detail. The attenuation of neutrons in H_2O at room temperatures and the effect of temperature on neutrons in H_2O were

studied. Measurements in heavy water were also made. (B.J.H.)

1505

THERMAL NEUTRON DISTRIBUTION DUE TO TIME-DEPENDENT FAST NEUTRON SOURCES IN NON-MULTIPLYING MEDIA. S. B. D. Iyengar and G. S. Mani (Atomic Energy Establishment, Bombay, India). Proc. Indian Acad. Sci. "A" 42, 175-91(1955) Oct.

The multigroup approximation for the attenuation of neutrons is developed, and the age theory approximation is shown to be a particular case resulting from the number of groups approaching infinity. Explicit solutions on two group and age approximations are obtained for an infinite geometry and a finite rectangular parallelopiped. (B.J.H.)

Refer also to abstracts 1422 and 1555.

NUCLEAR PHYSICS

1506 AECU-3110

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

ANNUAL PROGRESS REPORT [COVERING] RESEARCHES DURING THE PERIOD JUNE 1, 1954 TO MAY 31, 1955. 218p. Contracts AT(30-1)-905 and N5ori-07806.

A method has been developed to utilize the observed change in the ionization of a particle traversing a multiplate cloud chamber to give a more accurate value for that particle's range. An experiment is described for investigating the possibility of the existence of a charged K particle which decays with a lifetime of the order of a millisecond. The photoexcitation curve for $In^{115}(\gamma,\gamma')In^{115m}$ has been measured between 1 and 2 Mev using a Van de Graaff generator as an x-ray source. The relative yield of photoprotons from Cu^{63} and Cu^{65} foils irradiated with x rays has been measured using nuclear emulsions. A scintillation pair spectrometer for x rays is described. The reaction $O^{18}(p,n)F^{18}$ can be used for neutron flux calibration, and the neutron yield from LiF targets has been determined as a function of threshold peak position by this means. Inelastic proton scattering from gold and vanadium is being studied, and low-lying excited states of V^{51} are reported. Energy levels of Li^6, Ne^{20}, Na^{23}, A^{36}, and K^{39} are also being studied by inelastic proton scattering. Studies of the $O^{16}(d,\alpha)N^{14}$ reaction are reported. A study of the (d,p) reactions of Cl^{35} and Cl^{37} has been made, and energy levels in Cl^{36} and Cl^{38} are tabulated. The decay schemes of Cu^{60} and Al^{26} are being investigated to determine the possible existence of isomeric levels. Interactions of K^+ mesons have been studied in emulsion stacks, and results are summarized. Calculations on elastic K^+ scattering are described. The mean momentum of nucleons in various nuclei has been measured by determining the variation from deuteron kinematics in the ejection of neutron-proton pairs in the high energy photoeffect. The variation with atomic number of the cross section of the high energy photoeffect has been experimentally determined. The photoeffects in lithium and oxygen have been compared to the photodisintegration of the deuteron for 200 and 260 Mev photons. Data are presented on photoproton-proton coincidences observed in various nuclei. The proton-neutron mass difference is being studied theoretically. Problems in nuclear theory are briefly discussed. (Additional topics contained in the present annual report were also discussed in the preceding quarterly reports AECU-2973, -2991, and -3021. For preceding annual period see AECU-2943.) (M.P.G.)

1507 NP-5824

Naval Research Lab., Washington, D. C.

NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period July–September 1955. Oct. 1, 1955. 59p.

The design of a proposed neutron crystal spectrometer to be used with the NRL reactor is given. Results of experiments on the angular distribution of protons from the $Be^9(He^3,p)B^{11}$ reaction are given. Deuteron capture by He^3 was confirmed by bombarding a D target and observing the resultant γ spectrum. Calculated cross sections for 14-Mev neutrons in various elements are given. Efficiencies were calculated for NaI crystals, and the variation of efficiency with γ energy is shown for crystals of various sizes. Nuclear cross sections for neutrons and protons elastically scattered from Al and Pb were calculated by the WKB method. Mechanical and operational features of the design for an accelerator ion source are discussed. A comparison was made of the roentgen fields from Co^{60} and radium. Monte Carlo techniques were used to determine the γ ray albedo from iron, and results are given in graphical and tabular form. Reactor heat-transfer studies include boiling studies with DC heating, impulse heating studies, nucleate boiling caused by 15-mil Zircaloy wires, and boiling phase diagrams for 3-mil tungsten. Preliminary results are given on in-pile testing of the NRL carbon steel loop at the MTR. Techniques are given for the preparation of capsules to be used in corrosion studies. (For preceding period see NP-5722.) (B.J.H.)

1508 NYO-968

Brown Univ., Providence.

REACTION STUDIES WITH FAST NEUTRONS. Fifth [Annual] Progress Report. Russell A. Peck, Jr. Nov. 1, 1955. 38p. Contract AT(30-1)-1082.

Reactions examined include neutron scattering by natural lead, $Al^{27}(n,p)Mg^{27}$ and $Au^{197}(n,p)Pt^{197}$. Experimental results are preliminary in the last case. No rise in the lead cross section (elastic or inelastic) for back-scattering is found. From the (n,p) reactions, spectra levels are identified and nuclear temperatures and cross sections estimated. The tentative gold cross section appears anomalously large. Neutron production (intensity and homogeneity) from the D–T and D–D reactions under various target conditions are discussed, and advances in neutron and proton detection instrumentation described. (auth)

1509 UCRL-Trans-246

A POSSIBLE METHOD OF ELIMINATING THE DIVERGENCES IN THE PROBLEM OF THE INTERACTION OF NON-RELATIVISTIC NUCLEONS. E. L. Feinberg and D. S. Chernavskiy. Translated by Richard B. Mudge from Doklady Akad. Nauk S.S.S.R. 103, 421-4(1955) 8p.

Divergencies in the problem of the interaction of non-relativistic nucleons are discussed, and equations, based on a scheme not directly connected with the theory of excitations, are derived for the interaction. Results show that this semi-phenomenological method, which eliminates the natural energy in non-relativistic problems, may be regarded as a consistent method for the self-adjusting field in the meson theory of the interaction of nucleons. (B.J.H.)

1510

OBSERVATION OF ANTIPROTONS. Owen Chamberlain, Emilio Segre, Clyde Wiegand, and Thomas Ypsilantis (Univ. of California, Berkeley). Phys. Rev. 100, 947-50(1955) Nov. 1.

Announcement is made of the observation of the antiproton. The antiprotons were produced when the Bevatron proton beam impinged on a Cu target. The antiprotons were selected from the high meson background by a series of scintillation and Cherenkov counters in coincidence. Mass measurements were used to identify the particles as antiprotons. Possible spurious effects and further experiments are also discussed. (B.J.H.)

1511

THE QUADRUPOLE MOMENTS OF ODD A NUCLEI. M. A. Perks (Univ. of Birmingham, England). Proc. Phys. Soc. (London) A68, 1083-5(1955) Nov. 1.

Simple interconfigurational mixing does not meet with such success in attempting to account for the quadrupole moments of odd A nuclei as it did with the magnetic moments of such nuclei. The only explanation of the large quadrupole moments in the region $100 < A < 200$ appears to be that offered by the deformable core model. (auth)

1512

CENTRE-OF-MASS EFFECTS IN THE NUCLEAR SHELL-MODEL. J. P. Elliott and T. H. R. Skyrme (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A232, 561-6(1955) Nov. 22.

An examination is made of the possible errors that may arise in nuclear shell-model calculations by failing to separate out centre-of-mass motions from the internal motions of the system. A central oscillator potential is used to make possible a simple analysis. The most important effect is the appearance of spurious states that do not refer to the internal motion at all. These must be considered whenever the state is described by two or more unclosed shells (in the sense of L–S coupling), as, for example, in the excited states of O^{16}. (auth)

1513

CONSTRUCTION OF A SPECTROMETER FOR NEUTRINO RECOILS: INVESTIGATION OF THE DECAY OF A^{37}. O. Kofoed-Hansen and A. Nielsen. Kgl. Danske Videnskab. Selakab, Mat.-fys. Medd. 29, No. 15, 1955. 60p.

A neutrino recoil spectrometer has been constructed. The motion of the recoils has been studied in crossed electric and magnetic fields. The particles have been detected by the charge they give off to the collector system. First, the theory of the instrument is described; subsequently, details of its construction are given and, finally, results obtained in an investigation of A^{37} are presented. These results give a neutrino momentum of 812 ± 8 kev, % recoils of charge 1 as 26 ± 3, % recoils of charge 2 as 13 ± 4, % recoils of charge 3 as 38 ± 4, % recoils of charge 4 as 18 ± 2, % recoils of charge 5 as 4 ± 1, and % recoils of charge 6 as 1 ± 1. The average charge of the charged recoils is 2.64 ± 0.08. The momentum of the most energetic Auger electrons is 162 ± 4 Gauss cm. The % of decays leading to such electrons is 65 ± 5. The average momentum of all electrons is 69 ± 1 Gauss cm. (auth)

1514

BINDING STATES OF INDIVIDUAL NUCLEONS IN STRONGLY DEFORMED NUCLEI. Sven Gosta Nilsson. Kgl. Danske Videnskab. Selskab., Mat.-fys Medd. 29, No. 16, 1955. 69p.

A model is formulated for the interaction of nucleons with a deformed field by introducing a single-particle Hamiltonian containing a modified ellipsoidal oscillator potential and a spin-orbit term. A representation using the eigenvectors of an isotropic three-dimensional harmonic oscillator is introduced. Calculated single-particle eigenvalues are given in tables and diagrams. Applications of the single-particle states are discussed. (D.E.B.)

1515

MOMENTS OF INERTIA OF ROTATING NUCLEI. Aage Bohr and Ben Mottelson. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 30, No. 1, 1955. 24p.

The moments of inertia for rotating nuclei are considered in terms of the motion of the nucleons. The Hamiltonian for a system of interacting nucleons is discussed, and moments of inertia are evaluated. The observed moments are discussed. (D.E.B.)

1516

ON THE POTENTIAL COLLECTIVE FLOW OF A ROTATING NUCLEUS WITH NON-ELLIPSOIDAL BOUNDARY. Torsten Gustafson. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 30, No. 5, 1955. 16p.

Evidence of the rotational character and symmetry of nuclear motion is given by energy ratios, spins, and intensities. Nuclear motion is compared with the hydrodynamical flow of a liquid drop rotating without change of form. Equations for a rotating ellipsoid are developed and deviations considered. (D.E.B.)

1517

THE STATISTICAL THEORY OF HEAVY NUCLEI AND OF NUCLEAR FORCES. F. I. Kligman (Kiev Technological Inst. of Light Industry). Soviet Phys. JETP 1, 145-53 (1955) July. (In English). Zhur. Eksptl. i Teoret. Fiz. 28, 297-307(1955) July. (In Russian)

A statistical method representing a semi-classical approximation employing the self-consistent field method is developed for application to heavy nuclei. The method takes into consideration unfilled spin and charge states for various charge-symmetry functions of interaction between nucleons with the separation dependence having the form $-g^2e^{\quad}/r$. Equations have been derived and analyzed both for the case of completely filled state of nucleons as well as for the "charge" or "spin" states. Formulas have been obtained for the basic "isotopic" and supplementary term of the equation expressing the energy of a nucleus. A discussion is included regarding the influence of various properties of nuclear forces on the behavior of a complete nuclei. (auth)

NUCLEAR PROPERTIES

1518 ISC-555

Ames Lab., Ames, Iowa.

ASSIGNMENT OF TRANSITION MULTIPOLE ORDERS FROM L SUBSHELL INTERNAL CONVERSION COEFFICIENT RATIOS. Harry F. Frissel and E. N. Jensen. Dec. 1954. 49p. Contract W-7405-eng-82.

The L subshell internal conversion coefficient ratios $L_I/L_{II}/L_{III}$ were determined for the 112.0 kev transition from Lu^{177} and the 85.1 kev transition from Tb^{160} and were found to be < 0.05/1.14 ± 0.02/1.00 and 0.61 ± 0.10/0.87 ± 0.06/1.00, respectively. These data are consistent with

an E2 assignment for both transitions. The data were obtained with a variable field 180° β ray spectrometer. (auth)

1519 ORNL-1913
Oak Ridge National Lab., Tenn.
TABLE OF EIGENVALUES FOR PURE QUADRUPOLE SPECTRA, SPIN 5/2. Ralph Livingston and Henry Zeldes. July 13, 1955. 25p. Contract W-7405-eng-26.

1520 TID-5300
National Research Council. Committee on Tables of Constants and Numerical Data.
NUCLEAR LEVEL SCHEMES AND TABULAR DATA. K. Way. June 1955. 260p.

Level schemes and data are given on nuclides for A = 40 through A = 92. (B.J.H.)

1521 AERE-Lib/Trans-570
A SECOND ISOTOPE OF LUTETIUM AND THE MAGNETIC MOMENT AND QUADRUPOLE MOMENT OF THE NUCLEUS OF Lu_{71}^{175}. H. Gollnow. Translated by F. Hudswell from Z. Physik 103, 443-53(1936). 13p.

1522
EMPIRICAL CORRELATION OF NUCLEAR MAGNETIC MOMENTS. R. K. Osborn and E. D. Klema (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 822-34(1955) Nov. 1.

A simple generalization of the extreme shell model, based upon the kinematics of the collective model, is proposed for the correlation of nuclear magnetic moments. It is shown that, if the concept of a rotating core is adjoined to that of the single-particle model, largely in disregard of dynamical considerations, then by the aid of three simple empirical rules ground-state wave functions may be easily constructed which correctly express the parities, spins, and magnetic moments of all nuclei for which A≥7, with the exception of W^{183}. The choice of a particular set of empirical rules was dictated primarily by the twofold desire to keep their number to a minimum and at the same time restrict the consequent wave function to but two components; hence, considerable oversimplification of the true state of affairs is inevitable. However, the internal consistency of the results does point up strikingly the previously observed, but not explicitly investigated, possibility that the nature of the variable degrees of freedom required for generalization of the single-particle model may differ fundamentally for $j = l + \frac{1}{2}$ in contrast to $j = l - \frac{1}{2}$ single-particle configurations — being predominantly those of the core in the former instance and those of the single particle in the latter. (auth)

1523
K-SERIES FLUORESCENCE YIELDS OF ARGON, COPPER-65, AND INDIUM-113. G. R. Harrison, R. C. Crawford, and J. I. Hopkins (Vanderbilt Univ., Nashville, Tenn.). Phys. Rev. 100, 841-4(1955) Nov. 1.

K-series fluorescence yield measurements have been made for A, Cu^{65}, and In^{113} with a proportional counter spectrometer and found to be 0.081 ± 0.006, 0.39 ± 0.02, and 0.82 ± 0.02, respectively. The method is discussed and a comparison with theoretical values is noted. (auth)

1524
4.1×10^{-8} SECOND METASTABLE STATE IN Pa^{231}. D. Strominger and J. O. Rasmussen (Univ. of California, Berkeley). Phys. Rev. 100, 844(1955) Nov. 1.

A metastable state of Pa^{231} with a half life of (4.1 ± 0.4) $\times 10^{-8}$ second has been observed. The half life is exhibited by both 26- and 85-kev E1 gamma transitions. A comparison is made with the metastable state in Pa^{233}. Upper limits on lifetimes are given for the E1 gamma transitions in Np^{239} and Ac^{225}. The erratic variation in the lifetimes for E1 transitions is discussed. (auth)

1525
REACTIONS $Be^9(\alpha,\alpha')$, $Be^9(\alpha,d)$, AND $Be^9(d,d')$. V. K. Rasmussen, D. W. Miller, M. B. Sampson, and U. C. Gupta (Indiana Univ., Bloomington). Phys. Rev. 100, 851-5(1955) Nov. 1.

The existence of a level in Be^9 at 3.01 ± 0.1 Mev has been verified by the inelastic scattering of 21.6-Mev alpha particles and 10.8-Mev deuterons. Some evidence has also been found for a level in Be^9 at 1.74 ± 0.1 Mev. However, it is shown that the present experimental data are most simply explained by a three-body break-up of the compound nucleus with a final-state potential-scattering interaction between the outgoing neutron and Be^8. The previously-reported occurrence of the reaction $Be^9(\alpha,d)B^{11}$ to the ground state and 2.14-Mev excited state of B^{11} is verified. (auth)

1526
SYSTEMATICS OF FISSION ASYMMETRY. W. J. Swiatecki (Institute for Mechanics and Mathematical Physics) and Gustaf Werner (Inst. of Nuclear Chemistry, Uppsala, Sweden). Phys. Rev. 100, 936-7(1955) Nov. 1.

The square of the relative degree of fission asymmetry was plotted against Z^2/A of the target nucleus. The asymmetry was found to decrease with Z^2/A, and semi-empirical relations between Z^2/A and the degree of fission asymmetry are given. (B.J.H.)

1527
SYSTEMATICS OF SPONTANEOUS FISSION HALF-LIVES. W. J. Swiatecki (Institute for Mechanics and Mathematical Physics) and Gustaf Werner (Inst. for Nuclear Chemistry, Uppsala, Sweden). Phys. Rev. 100, 937-9(1955) Nov. 1.

Spontaneous fission half-lives are plotted against Z^2/A, and semiempirical formulas are given to fit the curves. (B.J.H.)

1528
NUCLEAR MOMENTS IN jj-COUPLING. S. Sengupta (Government Coll., Darjeeling, India). Phys. Rev. 100, 939-40(1955) Nov. 1.

A method of calculating the nuclear electric quadrupole moments of any I state, arising out of any equivalent proton configuration $(lj)^n$, without explicitly setting up the wave functions is extended to equivalent configurations containing both neutrons and protons. (B.J.H.)

1529
EFFECTS OF FINITE AMPLITUDE IN COULOMB EXCITATION. G. Breit and J. P. Lazarus (Yale Univ., New Haven, Conn.). Phys. Rev. 100, 942-3(1955) Nov. 1.

Estimates are described which show that the probability amplitudes in close collisions are large enough to be considered, especially as regards angular distribution effects. (B.J.H.)

1530
ELECTRIC-MONOPOLE TRANSITIONS IN ATOMIC NUCLEI. E. L. Church and J. Weneser (Brookhaven National Lab., Upton, N. Y.). Phys. Rev 100, 943-4(1955) Nov. 1.

The transition probabilities for electric monopole con-

version in the K shell are given for various atomic numbers as functions of the nuclear transition energy. The probabilities are also given as a function of atomic number for a transition of one mc^2. (B.J.H.)

1531

THE ABSOLUTE DETERMINATION OF RESONANT ENERGIES FOR RADIATIVE CAPTURE OF PROTONS BY SODIUM IN THE ENERGY RANGE BELOW 530 KEV. D. A. Hancock and F. Verdaguer (Associated Electrical Industries Ltd., Aldermaston, Berks, England). Proc. Phys. Soc. (London) A68, 1080-1(1955) Nov. 1.

Sodium targets were irradiated by the beam from a proton electrostatic generator. Resonant voltage, relative yield and half width measurements were in agreement with previously published results with one exception, the 250.8 ± 0.2 kev resonance. (D.E.B.)

1532

THE NUCLEAR MAGNETIC MOMENT OF HOLMIUM 165. J. M. Baker and B. Bleaney (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A68, 1090-1(1955)

Calculations leading to the values $\mu_n = 3.2_9 \pm 0.17$ b.m. and $Q \simeq 2 \times 10^{-24}$ cm^2 for the nuclear magnetic moment and nuclear electric quadrupole moment for Ho^{165} are given. (D.E.B.)

1533

POLARIZATION OF NUCLEONS. R. van Wageningen. Ned. Tijdschr. Natuurk. 21, 253-75(1955) Oct. (In Dutch)

1534

LOW ENERGY NEUTRON CROSS SECTION OF MANGANESE. R. Krotkov (Palmer Physical Lab., Princeton, N. Y.). Can. J. Phys. 33, 622-34(1955) Nov.

The total neutron cross section of Mn^{55} has three (predominantly scattering) resonances in the energy range 300 to 2500 ev. In the present paper these resonances are examined in detail from the point of view of the R matrix formalism. It is found that quite good (but not perfect) agreement with the experimental cross section curve is obtained by assigning (in order of increasing resonance energy) spins (2, 3, 3) and neutron widths (23, 11, 395 ev) to the resonances. The addition of a constant increment $\Delta R_{11} = 0.16 \times 10^{-12}$ cm., representing the contribution of distant positive-energy J = 3 resonances to the R matrix element for s-neutron scattering, improves agreement with experiment on the high energy side of the highest energy resonance. The (n, λ) cross section at 0.025 ev is fitted well by a constant radiation width of 0.5 ev. However, with no set of parameters was it possible to fit both the experimental total cross section curve, and the observed coherent scattering cross section at 0 ev although the sign of the latter was accounted for correctly. The discrepancy is 2.0 barns (calculated) compared to 1.7 barns (observed). (auth)

1535

THE EXCITED STATES OF EVEN-EVEN NUCLEI AND THE BOHR-MOTTELSON MODEL. Maurice Jean and Lawrence Wilets. Compt. rend. 241, 1108-10(1955) Oct. 24. (In French)

It is shown that the regularities occurring in the excited levels of even-even nuclei can be interpreted within the larger framework of a particular nuclear model. The model considered assumes that these nuclei can be described in a collective manner by the Bohr surface Hamiltonian, but that the influence of the individual nucleons appears in an effective potential which is not dependent on the symmetry properties of deformation. (B.J.H.)

1536

ON A NEW METHOD OF OBTAINING THE LEVELS OF NUCLEAR ROTATION(III). Claude Marty. Compt. rend. 241, 1112-13(1955) Oct. 24. (In French).

A detailed analysis is given of the manner of obtaining the rotational spectra of nuclei which have asymmetric cores or which have an axis of symmetry. (tr-auth)

1537

NUCLEAR SPIN OF POLONIUM-209 (Po^{209}). K. L. Vander Sluis and P. M. Griffin (Oak Ridge National Lab., Tenn.). J. Opt. Soc. Amer. 45, 1087(1955) Dec.

Spectrum photographs of a Po^{208-9} mixture have been made in the region from 2200 to 9000 A. Thirty-three lines with hyperfine structure were observed. Analysis of the data indicates an agreement with theoretical nuclear spins. (D.E.B.)

1538

LOW ENERGY LEVELS IN N^{16}. R. T. Pauli. Arkiv Fysik 9, No. 6, 571-601(1955). (In English)

The reaction $O^{18}(d, \alpha)N^{16}$ gives transitions to four α groups in the energy internal ($N^{16}-O^{16}$) = 9.3 to 11.6 Mev. If further levels exist, the transition to them at E_d = 850 kev are weaker than 0.005 to 0.15. A consideration of the spin and parities of the ground states of O^{18} and N^{16} shows that the transition to the ground state of N^{16} is in reasonable agreement with spin–parity selection rules. The lowest of the observed levels, 10.39 ± 0.03 Mev above the O^{16} ground state, is the assumed ground state of N^{16}. (D.E.B)

1539

ENERGY DEPENDENCY OF TOTAL NUCLEAR CROSS SECTIONS IN THE NEUTRON ENERGY RANGE FROM 380 TO 630 MEV. V. P. Dzhelepov, V. I. Satarov, and B. M. Golovin. (Inst. of Nuclear Problems.) Doklady Akad. Nauk S.S.S.R. 104, 717-20(1955) Oct. 11. (In Russian)

The total cross sections of neutron interaction with various nuclei in the energy range from 380 to 630 Mev are given. With the change of the energies from 360 to 630 Mev the cross sections of light nuclei (Be, C, O, Al) increase from 15 to 20%, while the cross section of heavy element nuclei (PbU) remain relatively unchanged. The scheme of the experiment and tabulations are presented. (R.V.J.)

1540

MAGNETIC MOMENT OF AN EXCITED STATE OF THE FLUORINE-19 NUCLEUS. P. B. Treacy (Australian National Univ., Canberra). Nature 176, 923-4(1955) Nov. 12.

1541

ON THE EXACT EVALUATION OF THE COULOMB EXCITATION. Kurt Alder and Aage Winther. Kgl. Danske Videnskab. Selakab, Mat.-fys. Medd. 29, No. 19, 1955. 20p. (In English)

It is shown that the calculation of the total cross section for Coulomb excitation can be reduced to the calculation of radial matrix elements between eigenstates in the Coulomb potential. Closed expressions, convenient series expansions, and recursion formulas for these matrix elements are given. The case of vanishing energy loss and the semi-classical limit are also discussed. (auth)

1542

TOTAL CHARGES AND ELECTRON CAPTURE CROSS-SECTIONS OF FISSION FRAGMENTS IN GASES. N. O.

Lassen. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 30, No. 8, 1955. 13p.

The curvature of fission fragment paths in a magnetic field have been measured to facilitate charge and electron capture cross section determinations. Results obtained for heavy and light fragments in H_2, He, and N_2 are given. (D.E.B.)

1543

MULTIPOLE ORDER OF THE γ-RAYS FROM $_{81}Tl^{208}$. O. B. Nielsen. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 30, No. 11, 1955. 16p.

The internal conversion lines originating in excited levels of $_{81}Tl^{208}$ have been obtained in coincidence with α particles from $_{83}Bi^{212}$. Five of the transitions were found to be magnetic dipole from their internal conversion coefficients. In three cases, the multipole order was confirmed by the K/L ratios. The results are compared with the model of Pryce. (auth)

Refer also to abstracts 1501, 1512, 1570, 1580, 1603, 1606, 1609, and 1650.

NUCLEAR REACTORS

1544 AECD-3666

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

CONTROL ROD THEORY FOR A CYLINDRICAL REACTOR. H. L. Garabedian. Aug. 9, 1950. Decl. with deletions July 20, 1955. 86p. Contract AT-11-1-GEN-14.

The work was carried out specifically for the purpose of making calculations associated with the control rod system for a cylindrical reactor. It is considered to be a combination and extension of the best results heretofore available in the American and Canadian literature on systems of rings of control rods in a cylindrical reactor. It gives a critical equation in the form of a determinantal critical equation for two rings of rods and a central rod and special cases of such a system, formulas for flux distributions, a discussion of rings of rods in a reflected reactor, a discussion of extensions to higher orders of approximations, and the foundation for further papers on the subject of both analytical and computational character. (auth)

1545 AECD-3670

Oak Ridge National Lab., Tenn.

FURTHER BOILING EXPERIMENTS IN THE LITR. W. M. Breazeale, T. E. Cole, and J. A. Cox. nd. Decl. Mar. 11, 1955. 6p. Contract [W-7405-eng-26].

The water in the active lattice of the Low Intensity Test Reactor was boiled, and the relation between the rate of boiling and the change in reactivity was measured. Pertinent data are summarized, and oscillograph tracings of neutron-flux transients are shown. (B.J.H.)

1546 AECD-3675

Hanford Atomic Products Operation, Richland, Wash.

THERMAL UTILIZATION AND LATTICE DIFFUSION LENGTH IN GRAPHITE–URANIUM LATTICES FROM EXPONENTIAL PILE MEASUREMENTS. C. R. Richey. Apr. 1, 1954. Decl. with deletions Aut. 23, 1955. __p. Contract W-31-109-Eng-52.

The diffusion lengths and thermal utilizations of a series of graphite-uranium lattices were determined from foil traverses within the lattice cells of exponential piles. Experimental techniques used for the foil traverses of the cells and the application of the data to the theory are discussed. The resulting values of the thermal utilizations and the lattice diffusion lengths are presented. The agreement of the thermal utilizations with those determined from the Volkoff-Rumsey equations is well within the experimental error. The diffusion lengths of the lattices as calculated by three different methods result in a spread of 2 to 5%, but it is not obvious which method gives the best value. (auth)

1547 AERE-C/R-1715

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks.

FISSION PRODUCT FORMATION IN A HOMOGENEOUS POWER REACTOR. C. J. L. Lock. June 28, 1955. 41p. (HARD/P3; RCTC/P53)

Calculation has been made of the weight, activity, and total neutron absorption cross section of the individual fission product isotopes present after irradiating a mass of uranium (U^{235}) for periods of 3, 6, 9, and 12 months at a neutron flux of 10^{15} n/cm^2/sec., the mass of uranium being maintained at one kilogram. An indication is given of the way in which these results can be applied to a homogeneous reactor. (auth)

1548 BNL-2385

Brookhaven National Lab., Upton, N. Y.

XENON INSTABILITY. W. A. Robba. Feb. 5, 1954. Decl. Nov. 21, 1955. 10p. Contract AT-30-2-Gen-16.

The change in reactivity of the Liquid Metal Fuel Reactor due to Xe burnout after a sudden flux jump was calculated. The results were plotted, and the initial slopes of the curves were compared with the negative temperature coefficient previously calculated. It was found that the overall coefficient was still negative over the entire range of values chosen. (M.P.G.)

1549 BNL-2386

Brookhaven National Lab., Upton, N. Y.

LMFR TEMPERATURE COEFFICIENT—XENON DEPENDENT. W. A. Robba. July 19, 1954. Decl. Nov. 21, 1955. 4p. Contract [AT-30-2-Gen-16].

The effect of change in Xe cross section with temperature on the reactivity coefficient of the Liquid Metal Fuel Reactor has been calculated. The reactivity coefficient due to Xe was found to be positive and of the order of magnitude of 10^{-6} or 10^{-5} for neutron flux from 10^{12} to 10^{16}. The negative "final" coefficient is therefore reduced but remains negative. With the neutron flux between 10^{14} and 10^{15} and Xe at equilibrium, the final coefficient is -1.4×10^{-4} per °C. With Xe kept at $\frac{1}{10}$ equilibrium, the effect of Xe is negligible. (M.P.G.)

1550 BNL-2397

Brookhaven National Lab., Upton, N. Y.

FISSION-PRODUCT POISONING IN THE LMFR. O. E. Dwyer. Mar. 2, 1955. Decl. Nov. 21, 1955. 3p. Contract AT-30-2-Gen-16.

The results of calculations are presented on the poisoning effect of fission products in the Liquid Metal Fuel Reactor. The percent of poisoning by the fission products which are more oxidizable than U and are removed in the salt extraction process, was determined to be 1.75. (M.P.G.)

1551 DL-20

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

REACTOR DESIGN AND TECHNOLOGY PRESENTED AT THE U. N. GENEVA CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, AUGUST 1955. W. B. Lewis. Aug. 1955. 17p. (AECL-252).

The types of reactors proposed at the Geneva Conference for power production are reviewed. The various types are discussed from the standpoints of fission product control, coolant requirements, and fuel economy. (D.E.B.)

1552 HW-27061

[Hanford Works, Richland, Wash.]

TRANSFORMATION AND MAGNETIC PHENOMENA OCCURRING IN BORON STAINLESS STEEL VERTICAL SAFETY RODS. R. E. Huaschen and R. S. Kemper. Feb. 6, 1953. Decl. Aug. 2, 1954. 15p. Contract [W-31-109-Eng-52].

The boron-stainless steel alloy used for vertical safety rods are tube sections which were centrifugally cast into permanent-type molds. The sections were then machined and assembled into a standard length safety rod. The first difficulty encountered in their fabrication was during the machining operation in which magnetic "hard spots" reduced tool life considerably. The second difficulty encountered was during assembly when a volume increase of the tube sections, resulting from the insertion of a subzero cooled stainless steel plug, prevented satisfactory assembly. During this low temperature treatment, the tubes also became strongly magnetic, an undesirable operating condition. The low carbon 18-8 stainless steels containing approximately 1.7% boron used for vertical safety rods at Hanford were found to be structurally stable in the temperature range 0 to 450°C. The addition of boron decreases the stability of this metastable austenitic alloy. Sufficient ferrite formation is induced by sub-zero temperature treatments to result in dimensional changes and a magnetic alloy. The difficulties encountered in machining this material are believed to be due primarily to segregation in the castings resulting in small areas of the hard intermetallic compound, FeB. (auth)

1553 HW-33434(Rev.)

Hanford Atomic Products Operation, Richland, Wash.

HEAT TRANSFER ANALYSIS OF INTERNALLY-EXTERNALLY COOLED CYLINDRICAL FUEL ELEMENTS FOR NUCLEAR REACTORS. F. E. Tippets. Oct. 15, 1954. 39p. Contract W-31-109-Eng-52.

The complete detailed development of a non-iterative method of analysis of heat transfer characteristics of internally-externally cooled elements is presented. The resulting equations can be applied as well to problems concerning the various types of single-surface cooled elements, which can be considered as special cases. The basic working equations are summarized, and a brief description of typical methods of using them is given. (auth)

1554 HW-35038

Hanford Atomic Products Operation, Richland, Wash.

CORRELATION OF EXPONENTIAL PILE LATTICE MEASUREMENTS WITH THEORY. E. D. Clayton and C. R. Richey. Feb. 8, 1955. Decl. Sept. 19, 1955. 22p. Contract W-31-109-Eng-52.

Using diffusion theory type formulas for the calculation of thermal utilization and resonance escape probabilities, and in particular those formulas of Rumsey and Volkoff, an effort has been made to correlate experimentally measured bucklings (Exponential Pile Program at Hanford) with those calculated from theory. A simple method for the determination of the effective resonance cross section, σ_{eff} and $\eta\epsilon$ that will permit the correlation of the experimental and theoretical buckling values for various lattice spacings with the 1.36 in. diameter fuel element is given. The values of $\eta\epsilon$ and σ_{eff} which best fit the dry lattices are 1.3465 and 1.693 barns, respectively, and those for the wet lattices are 1.3492 and 1.671 barns, respectively. An "effective" value of η is implied by these calculations (based on a calculated ϵ) which is 1.304 for the dry lattice and 1.306 for the wet lattice. A table showing the buckling correlation and values of the various lattice parameters is presented. (auth)

1555 IDO-16047

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

NEUTRON FLUX DISTRIBUTIONS IN THE MATERIALS TESTING REACTOR. Part I. G. O. Bright and F. Schroeder. Feb. 16, 1953. Decl. Aug. 30, 1955. 150p. Contract AT(10-1)-205.

A series of neutron flux distribution determinations has been made in the MTR. These include complete three-dimensional maps made inside the reactor tank for the reactor conditions of fresh fuel charge and depleted, poisoned fuel charge. A series of measurements in the horizontal beam facilities is shown. The data are presented as a series of relative activity curves and as a set of absolute flux maps. Absolute values are considered valid within ±20%. (auth)

1556 KAPL-546

Knolls Atomic Power Lab., Schenectady, N. Y.

NUCLEAR POWER CONSIDERATIONS. Nuclear Engineering Course 1948–1949. R. G. Lorraine. (Lecture Notes by A. M. Anderson). May 5, 1949. Decl. Nov. 22, 1955. 18p.

The development of nuclear power plants is discussed. Included are discussions of the rate of growth of power capacity, the form of a high efficiency nuclear power production system, the economic and technical obstacles to nuclear power production, proposed operating conditions of a nuclear power plant, the heat source of the reactor, and the heat exchanger system. (B.J.H.)

1557 NCSC-108

North Carolina State Coll., Raleigh.

FURTHER DATA ON REACTOR OPERATIONS UP TO REMOVAL OF FUEL FROM THE FUEL CYLINDER. A. C. Menius, Jr., H. A. Lamonds, Charles W. Terrell, Dexter Whitehead, Jr., David Lintz, Arthur W. Waltner, E. J. Brown, J. G. Lundholm, Jr., and Clifford K. Beck. Aug. 10, 1955. 18p.

A detailed chronological account is given of the events leading to the discovery of a fuel leak and of the subsequent operation of the reactor until the fuel was removed from the fuel cylinder. (B.J.H.)

1558 NDA-14-34

Nuclear Development Associates, Inc., White Plains, N. Y.

DETERMINATION OF CYLINDRICAL DIFFUSION EQUATIONS FOR TWO REGION REFLECTOR-BLANKET CONFIGURATION. G. Goertzel. Apr. 13, 1954. 12p.

A method is developed to enable the estimation of neutron leakage out of the ends of the coolant passage in a

cylindrical reflector-blanket configuration surrounding a cylindrical coolant channel. (auth)

1559 NDA-14-46

Nuclear Development Associates, Inc., White Plains, N. Y.

STRESS AND STRAIN DUE TO THERMAL EXPANSION IN A RAPIDLY HEATED SPHERE. G. Goertzel. Aug. 2, 1954. 24p.

The time behavior of a rapidly heated spherical core of a nuclear reactor is studied. Inertial effects are considered. Spherical symmetry is assumed. Equations convenient for numerical evaluation for specified heating are presented. (auth)

1560 NDA-14-58

Nuclear Development Associates, Inc., White Plains, N. Y.

MATHEMATICAL ANALYSIS OF DIFFERENTIAL EQUATIONS ARISING IN THE FAST REACTOR SAFETY STUDY. H. V. Waldinger. Nov. 12, 1954. 25p.

Methods are presented for carrying out the numerical analysis of equations which characterize the dynamical behavior of an idealized reactor. These methods have been applied in specific problems of the APDA fast reactor safety study. (auth)

1561 NDA-14-84

Nuclear Development Associates, Inc., White Plains, N. Y.

FAST REACTOR ACCIDENT SCALING LAWS. R. A. Daane. May 18, 1955. 25p.

The self limitation of an accidental power excursion by thermal expansion of the fuel in a fast reactor with core-length metallic rod-type fuel elements is analyzed. Approximate formulas are presented for the peak power, temperature rise, and stress induced in the fuel rods, taking into account the inertia effects. (auth)

1562 WAPD-TN-522

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

DISTRIBUTION OF FISSION PRODUCT GASES IN PWR TYPE REACTOR SYSTEMS. F. E. Obenshain and B. D. O'Reilly. Oct. 1955. 27p.

The distribution of fission product gases in PWR-type reactor systems is calculated for the continuous release of fission product gases into the primary coolant caused by a small fracture of the fuel element cladding. Activity in the transfer canal air is also calculated. The instantaneous release of fission products into the primary coolant is also discussed, and distributions of fission product gases are calculated. Rate equations accounting for the buildup of activity in the core, coolant, and system surfaces are given. Consideration is also given to the case for which the amount of isotope released is proportional to the total quantity existing. Lists of fission products and fission product gases are included. (B.J.H.)

1563 WASH-292(Pt.3, Suppl. 1)

Division of Reactor Development, AEC.

SHIELDING THE APPR-1. J. L. Meem and F. B. Bairbanks (ALCO Products, Inc., New York). Supplement to REACTOR SHIELDING INFORMATION MEETING, MAY 12–13, 1955, ENGINEER RESEARCH AND DEVELOPMENT LABORATORIES, FORT BELVOIR, VIRGINIA. PART 3, SUPPLEMENT 1. Sept. 1955. 17p.

The general considerations in the design of the Army Package Power Reactor shielding are discussed. Complete descriptions are given of the primary and secondary shields. Dose rates outside of the shields are calculated at various times after shutdown, during operation, and during spent fuel element transfer. (B.J.H.)

1564

FISSION-PRODUCT BUILDUP IN LONG-BURNING THERMAL REACTORS. W. L. Robb, J. B. Sampson, Jr., R. Stehn, and J. K. Davidson (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 13, No. 12, 30-3(1955) Dec.

Poisoning by fission products in thermal reactors is evaluated from data on fission yields and cross sections of U^{235}. The effect of fission-product gas removal on the fission product poisoning for U^{235} is shown. The distribution of fission product poisoning by elements is also tabulated. (B.J.H.)

1565

HOW TO CONTROL A BOILING REACTOR. John Macphee (American Machine and Foundry Co., Greenwich, Connecticut). Nucleonics 13, No. 12, 42-5(1955) Dec.

The basic design of a boiling reactor plant is discussed. The change in moderator density under various conditions and several basic control systems are briefly discussed. (B.J.H.)

1566

THE PROPOSED BROOKHAVEN MEDICAL RESEARCH REACTOR. J. S. Robertson, E. Stickley, V. P. Bond, and Le. E. Farr (Brookhaven National Lab., Upton, New York). Nucleonics 13, No. 12, 64-8(1955) Dec.

Designs are proposed for a reactor using "swimming pool" type fuel elements and an air-cooled graphite reflector-moderator. The reactor will have a thermal neutron flux of 10^{10} to 10^{11} n/cm^2/sec, and will operate at up to 1 Mw power. The reactor is designed for use in medical and biological studies. (B.J.H.)

1567

HOW TO USE TWO-PHASE SERVOMOTORS TO DRIVE REACTOR SHIM RODS. D. R. Whitehouse, F. W. Bradley, A. S. Hoffman, and R. C. Reid (M.I.T. Engineering Practice School, Oak Ridge, Tenn.). Nucleonics 13, No. 12, 70-1 (1955) Dec.

The behavior of two-phase servomechanism motors running from a single phase supply is studied, and the use of such motors for driving reactor shim rods is discussed. (B.J.H.)

Refer also to abstracts 1330, 1332, 1336, 1337, 1409, and 1498.

NUCLEAR TRANSFORMATION

1568

STRIPPING OF SINGLY CHARGED ARGON IONS IN HELIUM, NEON, ARGON, AND KRYPTON AT 40 TO 180 KEV. D. M. Kaminker and N. V. Fedosenko. Zhur. Tekh. Phys. 25, 1843-53(1955) Nov. (In Russian)

Results of experiments determined the existence of a single stage stripping process with simultaneous explusion of a large number of electrons out of the ion shell. The stripping process of the $A^+ \rightarrow A^{2+}$, $A^+ \rightarrow A^{3+}$, $A^+ \rightarrow A^{4+}$, $A^+ \rightarrow A^{6+}$, $A^+ \rightarrow A^{7+}$, and $A^+ \rightarrow A^{8+}$ was observed. Effective cross sections were obtained for ions stripped while in their initial forward motion. (R.V.J.)

1569

THE PRODUCTION OF ^{11}C FROM CARBON BY PROTONS OF ENERGY BETWEEN 200 AND 950 MEV. W. E. Burcham, J. L. Symonds, and J. D. Young (Univ. of Birmingham, England). Proc. Phys. Soc. (London) A68, 1001-7(1955) Nov. 1.

Polystyrene discs were irradiated in the scattered proton beam of the Birmingham synchrotron. The proton flux was found by counting tracks in a nuclear emulsion exposed near the polystyrene disc. From the observed activity of the discs the cross section for the production of 20.5 min C^{11} from C by 950 Mev protons was found to be 20.5 ± 1.1 mb. The variation of cross section over the energy range 200 to 950 Mev was also studied. (auth)

1570

NEUTRON GROUPS FROM DEUTERON STRIPPING BY ^{23}Na, ^{27}Al AND ^{31}P. J. M. Calvert, A. A. Jaffe, A. E. Litherland, and E. E. Maslin (Univ. of Liverpool, England). Proc. Phys. Soc. (London) A68, 1008-16(1955) Nov. 1.

Using a triple ionization chamber to collimate and record recoil protons from a hydrogenous radiator, angular distribution measurements have been carried out on a number of neutron groups emitted as a result of the bombardment by 9 Mev deuterons of targets of $NaCO_3$, Al and P. Spins and parities of the resulting states of the 4n nuclei Mg^{24}, Si^{28} and S^{32} have been assigned by applying the theory of the stripping process. In the case of Si^{28}, the first T = 1 level is identified and its characteristics compared with those of the ground state of Al^{28}. (auth)

1571

AN INVESTIGATION OF THE REACTION $^{19}F(d,n)^{20}Ne$ USING A NEW FAST-NEUTRON SPECTROMETER. J. M. Calvert, A. A. Jaffe, and E. E. Maslin (Univ. of Liverpool, England). Proc. Phys. Soc. (London) A68, 1017-25(1955) Nov. 1.

A description is given of a new fast-neutron spectrometer which utilizes scintillation counters and which has a relatively high efficiency of detection. The instrument is suitable for use at neutron energies of 4 Mev and above and has been used to investigate the stripping reaction $F^{19}(d,n)Ne^{20}$. The angular distribution of four neutron groups has been found and the theory of the deuteron stripping process has been applied to analyze the results and to obtain information about the corresponding levels in Ne^{20}. (auth)

1572

GAMMA RADIATION FOLLOWING THE SURFACE SCATTERING OF NUCLEONS. G. R. Satchler (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A68, 1037-40(1955) Nov. 1.

The nuclear reactions (n,n′), (p,p′), (n,p) and (p,n) are considered to take place by the direct collision of nucleons at the surface of the target nucleus. The angular distribution of any γ rays following these reactions is considered, and two simple cases presented explicitly. (auth)

1573

POLARIZATION IN NUCLEAR REACTIONS. G. R. Satchler (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A68, 1041-4(1955) Nov. 1.

Simple formulas are given for the polarization effects in nuclear reactions of spin ½ particles and photons, and applied to elastic scattering by a potential well with spin-orbit coupling. (auth)

1574

THE ANGULAR DISTRIBUTION OF $^7Li(p,n)^7Be^*$ NEUTRONS FOR PROTON ENERGIES BETWEEN 2.5 AND 2.9 MEV. R. Batchelor and G. C. Morrison (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A68, 1081-3(1955) Nov. 1.

Previous measurements of neutron angular distribution in the reaction $Li^7(p,n)Be^7$ have been extended to incident proton energies of 2.9 Mev. The observations below 2.7 Mev are consistent with an S-wave interaction. (D.E.B.)

1575

GAMMA RAYS FROM THE REACTIONS $Be^9(\alpha,n\gamma)C^{12}$, $C^{13}(d,p\gamma)C^{14}$, $N^{14}(d,p\gamma)N^{15}$, AND $N^{14}(d,n\gamma)O^{15}$. R. D. Bent, T. W. Bonner, J. H. McCrary, and W. A. Ranken (Rice Inst., Houston, Tex.). Phys. Rev. 100, 771-4(1955) Nov. 1.

A magnetic-lens pair spectrometer has been used to study the radiations produced by the bombardment of certain light nuclei with α particles and deuterons from The Rice Institute Van de Graaff accelerator. From the bombardment of Be^9 with 4.3-Mev α particles a single γ ray was observed at 4.48 ± 0.06 Mev, doppler corrected. No 7.6-Mev nuclear pair line was observed with an intensity as great as 5% that of the 4.48-Mev internal pair line. No 3.2-Mev γ radiation was observed with an intensity as great as 8% that of the 4.48-Mev γ ray. A comparison of the internal and external pair spectra from the $C^{13}(d,p\gamma)C^{14}$ reaction has been made to obtain information on the multipolarities of the 6.1- and 6.7-Mev γ rays from C^{14}. If the 6.1-Mev γ ray is assumed to be E1, the relative intensities of the 6.1- and 6.7-Mev lines suggest that the 6.7-Mev γ ray is E2; however, other multipoles such as E1, M1, and E3 cannot be excluded. A study of the γ rays from the reactions $N^{14}(d,p\gamma)N^{15}$ and $N^{14}(d,n\gamma)O^{15}$ shows that the (d,p) cross section is 2.6 times larger than the (d,n) cross section at 2.4-Mev bombarding energy, whereas the two cross sections are about equal at 5.3-Mev bombarding energy. (auth)

1576

GAMMA RAYS FROM THE DEUTERON BOMBARDMENT OF Al^{27} AND P^{31}. R. D. Bent, T. W. Bonner, J. H. McCrary, and W. A. Ranken (Rice Inst., Houston, Tex.). Phys. Rev. 100, 774-6(1955) Nov. 1.

A magnetic-lens pair spectrometer has been used to study the radiations produced by the bombardment of Al^{27} and P^{31} with 4.6-Mev deuterons from The Rice Institute Van de Graaff accelerator. Gamma rays from the bombardment of Al^{27} were observed at 6.9 ± 0.1, 7.38 ± 0.06, 7.55 ± 0.06, 7.91 ± 0.04, 8.28 ± 0.04, 8.75 ± 0.04, 9.08 ± 0.04, 9.45 ± 0.08, 9.87 ± 0.08, and 10.7 ± 0.2 Mev. Gamma rays from the bombardment of P^{31} were observed at 4.41 ± 0.04, 4.71 ± 0.04, 4.94 ± 0.04, 5.29 ± 0.04, 5.79 ± 0.04, 6.11 ± 0.04, 6.84 ± 0.04, 7.46 ± 0.08, 8.16 ± 0.04, and 8.53 ± 0.04 Mev. All energies are doppler-corrected. (auth)

1577

(γ,p) REACTION IN ARGON-40. B. M. Spicer (Univ. of Illinois, Champaign). Phys. Rev. 100, 791-6(1955) Nov. 1.

The energy distribution and angular distribution of photoprotons from argon irradiated with 22.5-Mev bremsstrahlung have been measured. The yield of protons was found to be 6.6×10^5 protons per mole per r, in good agreement with Saskatoon results. The angular distribution of protons indicated that the absorption was predominantly electric dipole, as expected. The energy distribution peaked at 2.6 Mev, and, from its characteristics, it was

inferred that the Coulomb barrier for protons plus Cl^{39} was only about 2.5 Mev, and that the level density in Cl^{39} increased with energy approximately as exp(E). These results are discussed in terms of the compound nucleus model and the direct photoeffect model. (auth)

1578

ABSOLUTE CROSS SECTIONS FOR DEUTERONS ON BERYLLIUM. Robert E. Heft and W. F. Libby (Institute for Nuclear Studies, Chicago). Phys. Rev. 100, 799-813 (1955) Nov. 1.

The absolute cross section for the reactions of deuterons on beryllium which produce tritium and Be^{10} have been measured up to energies of 17 to 20 Mev. Data of Dejong, Endt, and Simons show no threshold which is as expected for exothermic (d,p) and (d,t) processes. For the reaction producing Be^{10}, which is equivalent to the introduction of a neutron into the beryllium nucleus by the bombarding deuteron, the cross section rises to a peak value of about 0.34 barn, at about 4 Mev. It then falls almost linearly to the low value of 0.08 barn at 20 Mev. There are evidences of fine structure in the curve but it is possible that these are not really significant. The reaction producing tritium rises to a peak value of about 0.23 barn at about 5 Mev and then falls to a low value of about 0.03 barn at 13 Mev. The reaction cross section appears to remain essentially constant at this low value although it may rise slightly as the energy is raised to about 20 Mev. A new reaction producing tritium begins at 17.47 Mev, namely one which produces both tritium and Be^{7} simultaneously. This corresponds to the ejection of both a triton and a neutron as a result of the deuteron Be^{9} collision. This cross section rises from zero at the threshold linearly to a value of 8×10^{-5} barn at 21.5 Mev. (auth)

1579

(d,n) REACTIONS ON BORON AND CARBON. J. B. Marion, T. W. Bonner, and C. F. Cook (Rice Inst., Houston, Tex.). Phys. Rev. 100, 847-51(1955) Nov. 1.

The counter ratio method has been used to investigate neutron thresholds in the (d,n) reactions on B^{10}, B^{11}, C^{12}, and C^{13}. Thresholds were found corresponding to excited states in C^{11*} at 8.107, 8.430, and 8.660 Mev; in C^{12*} at 15.100 Mev; in N^{13*} at 2.37 Mev; and in N^{14*} at 5.683 Mev. Resonances in the reaction C^{12}(d,n) were found at 3.01 and 3.36 Mev and in the reaction C^{13}(d,n) at 1.80, 2.45, and 3.46 Mev. The absolute cross sections for the reactions B^{10}(d,n), B^{11}(d,n), and C^{13}(d,n) were measured. (auth)

1580

THE FISSION YIELDS OF THE CESIUM ISOTOPES FORMED IN THE THERMAL NEUTRON FISSION OF U^{235} AND THE NEUTRON ABSORPTION CROSS SECTION OF Xe^{135}. J. A. Petruska, E. A. Melaika, and R. H. Tomlison (McMaster Univ., Hamilton, Ont., Canada). Can. J. Phys. 33, 640-9(1955) Nov.

The absolute fission yields of the cesium isotopes occurring in the thermal neutron fission of U^{235} have been determined with a mass spectrometer using isotope dilution techniques. Values of 6.59%, 6.41%, and 6.15% have been obtained for the yields of Cs^{133}, Cs^{135}, and Cs^{137} respectively. The neutron absorption cross section of Xe^{135} has also been measured to be 866 times greater than that of B^{10} for a Maxwellian distribution of neutron velocities corresponding to a neutron temperature of 57°C. This ratio gives a thermal neutron absorption cross section of 3.47×10^{6} barns for Xe^{135}, assuming it is a $1/v$ detector. (auth)

1581

THE ABSOLUTE FISSION YIELDS OF TWENTY-EIGHT MASS CHAINS IN THE THERMAL NEUTRON FISSION OF U^{235}. J. A. Petruska, H. G. Thode, and R. H. Tomlinson (McMaster Univ., Hamilton, Ont., Canada). Can. J. Phys. 33, 693-706(1955) Nov.

Twenty-eight absolute fission yields totalling 78% of the heavy and 16% of the light fragments have been determined using the mass spectrometer and isotope dilution techniques. The precision of the values obtained is in most cases better than 2%, and the absolute accuracy is estimated to be about 3%. Fine structure in the mass-yield curve is discussed in terms of structural preference and various chain branching mechanisms. (auth)

PARTICLE ACCELERATORS

1582 AERE-GP/R-1742

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

TRAVELLING WAVE SYSTEMS WITH DIFFERENT PARTICLE AND WAVE VELOCITIES. L. B. Mullett. Sept. 7, 1955. 11p.

In a linear accelerator employing drift tubes, particles of any velocity can be accelerated in a travelling wave fashion by a wave of any velocity (backwards or forwards) by suitable choice of drift tube length and spacing. For particle velocities around 0.3 to 0.6c, such a system employing a backward travelling wave appears to be of considerable practical value. (auth)

1583 AERE-X/R-1771

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

NON-LINEAR EFFECTS IN ALTERNATING GRADIENT SYNCHROTRONS. P. A. Sturrock. Oct. 1955. 41p.

A perturbation procedure applied to an investigation of non-linear effects in the bevatron oscillations of strong-focusing synchrotrons. Quadratic terms in the trajectory equations introduce new instabilities which make it necessary to avoid further lines in the characteristic-phase diagram, but one is led to expect that higher terms will normally produce few further instabilities. It is suggested that the magnetic field should be shaped so as to satisfy a certain criterion which will guard against the possibility of higher-order instabilities. It is found that, as in the linear problem, only one of the two sets of diagonal lines associated with coupling terms represents possible modes of instability. Results are represented diagrammatically in three ways: by invariant contours in the phase plane; by 'configuration diagrams' which are convenient transformations of the preceding phase diagrams; and by curves which show how the amplitudes of fixed orbits vary with characteristic phase. Formulae are given which should make it possible to calculate the magnitude of non-linear effects which will arise in a given design subject to prescribed disturbances. (auth)

1584 UCRL-1173

California. Univ., Berkeley. Radiation Lab.

RF FIELD INVESTIGATIONS ON THE 1/10 SCALE MARK I CAVITY. Mitchell Dazey, Dale Nielsen, Raymond Robertson, and Duane Sewell. Mar. 13, 1951. Decl. Nov. 22, 1955. 190p. Contract W-7405-eng-48.

A complete investigation was made of the r-f field in the 1/10-scale Materials Testing Accelerator (Mark I) cavity.

Included are discussions of theoretical considerations of losses, voltages, stored energy, and other quantities, the mechanical design, oscillator construction and power requirements, field-measuring equipment and techniques, measurement of Q, drift-tube-stem investigations and field measurements on $8\frac{1}{2}$-drift tube model, and the absolute frequency and perturbations. (B.J.H.)

1585 UCRL-2672
Radiation Lab., Univ. of Calif., Berkeley
PARTICLE ACCELERATORS. I. BIBLIOGRAPHY. II. LIST OF HIGH-ENERGY INSTALLATIONS. Frederick E. Frost and Jane M. Putnam. Nov. 16, 1954. 83p. Contract W-7405-eng-48.

1586 UCRL-3150
California. Univ., Berkeley. Radiation Lab.
RADIOFREQUENCY POWER LOSSES COMPARED FOR FOUR LINEAR ACCELERATOR CONFIGURATIONS. Robert A. Weir. Sept. 30, 1955. 16p. Contract W-7405-eng-38.

The rf power losses per Mev particle energy gain for four possible deuteron-accelerating devices are computed over a deuteron energy range of $1 \leq KE \leq 400$ Mev. The configurations considered are (A) the conventional drift-tube-type linear accelerator, (B) a series of "pillbox" resonators each oscillating 180° out of phase with its successor and each containing two half drift tubes, (C) a series of pillbox resonators with no drift tubes, and (D) a helical wave guide. Values for the frequency, electric field strength, and other parameters of the various configurations considered needed for the calculation of the numerical results in this report were chosen which compare with those which presumably will be employed in further accelerator construction at Livermore. The numerical results indicate that in the deuteron energy range $1 < KE < 40$ Mev Cases (A) and (D) are relatively efficient, while in the range $200 < KE < 400$ Case (B) is relatively efficient. Of particular interest is the point at which the ascending power loss curve of Case (A) crosses the descending curve of Case (B). This was found to be in the neighborhood of 125 Mev. Case (C) was found to be comparatively inefficient. (auth)

1587 UCRL-3187
California. Univ., Berkeley. Radiation Lab.
STUDIES WITH A THREE-DEE THREE-PHASE PROTON CYCLOTRON. Myron Heusinkveld, Mark Jakobson, Lawrence Ruby, Bob H. Smith, and Byron T. Wright. Nov. 7, 1955. 15p. Contract W-7405-eng-48.

As part of the program to investigate the properties of the cloverleaf cyclotron, a 20-inch-diameter proton cyclotron was constructed. In such a three-dee three-phase system, it is possible to accelerate protons, deuterons, and tritons at the same setting of frequency and magnetic field but on different modes of the rf. For stable operation in the proper mode and with balanced voltages, it has been found necessary to provide both phase servos and amplifier efficiency servos. The dees could not be servoed individually until the interdee capacity was neutralized. Under such conditions it was possible to attain steadily 6.0 ma of protons at 1.0 Mev in the forward mode and 6.5 ma of deuterons at 0.5 Mev in the reverse mode. (auth)

1588 AEC-tr-2267
THE POSSIBILITY OF ELIMINATING CRITICAL ENERGY IN A STRONG FOCUSING ACCELERATOR. V. V. Vladimirskii and E. K. Terasov. Translated from p.13-22 in "Certain Problems of the Theory of Cyclic Accelerators." Moscow, U.S.S.R. Academy of Sciences, 1955. 13p.

The critical energy in a strong-focusing accelerator is eliminated at the expense of the resonance modification of the magnetic field configuration. Magnets, having periods approximating the period of betatron oscillations, with opposite signs, are arranged along the orbit. When the momentum of the particles deviates from the equilibrium value, forced oscillations originate which compensate the usual change of the length of the orbit for particles having a nonequilibrium momentum. The critical energy is then removed to infinity. A mathematical treatment is given. (D.E.B.)

1589 AEC-tr-2268
A STOCHASTIC METHOD OF PARTICLE ACCELERATION. E. L. Burshtein, V. I. Veksler, and A. A. Kolomenskii. Translated by V. N. Rimsky-Korsakoff from p.3-6 in "Certain Problems of the Theory of Cyclic Accelerators." Moscow, U.S.S.R. Academy of Sciences, 1955. 6p.

A new method of particle acceleration, the so-called stochastic probability method, is discussed. The mechanism of acceleration is a probability mechanism as distinguished from resonance or induction. An expression is derived for the probability of a charged particle attaining a given energy after passing through gaps charged with an alternating electric voltage. It is suggested that stochastic acceleration plays a significant part in the accumulation of energy of cosmic particles. (M.P.G.)

1590 AERE-Lib/Trans-582
STABILIZATION OF THE ENERGY OF IONS ACCELERATED BY A HIGH-VOLTAGE ELECTROSTATIC GENERATOR. V. G. Brovchenko, B. M. Gokhberg, and V. M. Morozov. Translated by V. Beak from Doklady Akad. Nauk S.S.S.R. 101, 1023-5(1955). 4p.

The principles of a scheme for the energy stabilization of ions accelerated by an electrostatic generator are discussed, and a diagram of the system is given. In the system, a change in the ion beam trajectory in a constant magnetic field signals a voltage deviation, and restoration of the voltage is made by a corresponding change of the current sent by an electron gun to the high-voltage electrode. (B.J.H.)

1591
ACCELERATORS OF CHARGED PARTICLES. A. A. Kolomenskiĭ and N. B. Rubich. Priroda 44, 3-12(1955) Nov. (In Russian)

Review of linear acclerators, cyclotrons, synchrocyclotrons, and cosmotrons with general description of their work is given. (R.V.J.)

1592
ELECTRONIC EQUIPMENT FOR AN ELECTRON ANALOGUE ACCELERATOR. J. G. Cottingham, M. Plotkin, and E. C. Raka (Brookhaven National Lab., Upton, N. Y.). I.R.E. Trans. Nuclear Sci. NS-1, 12-17(1954).

An electron analogue accelerator 45 feet in diameter is being constructed to test a variety of orbital properties of a strong-focusing synchrotron system. High-voltage sawtooth wave generators will supply the electrostatic bending and correcting lenses. A feed-back type radio frequency control and power amplifier supply a simple low-Q ferrite accelerating cavity. The rf control is designed to accommodate the phase stability transition encountered in strong-focusing synchrotrons. Auxiliary electronic systems will detect, observe, and time the circulating electron beam. (auth)

Refer also to abstracts 1448, 1458, and 1502.

RADIATION ABSORPTION AND SCATTERING

1593
POLARIZATION OF PROTONS ELASTICALLY SCATTERED FROM NUCLEI. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 886-90(1955) Nov. 1.

The polarization of 130-Mev protons elastically scattered from Be, C, Al, and Fe has been calculated by means of the optical model of the nucleus, including a spin-orbit coupling term. The results are in reasonable agreement with the measurements of Dickson, Rose, and Salter. Calculations were also carried out for proton energies of 50 Mev and 90 Mev, in order to explain the rapid decrease of the polarization as the energy is decreased below 130 Mev. By using a central potential whose real part decreases with increasing proton energy between 50 Mev and 130 Mev, reasonably good agreement was obtained for the dependence of the polarization on energy for Be and C. (auth)

1594
p-p INTERACTIONS AT 3 BEV. R. Cester, T. F. Hoang, and A. Kernan (Univ. of Rochester, N. Y.). Phys. Rev. 100, 940-2(1955) Nov. 1.

A study was made of p-p interactions in Ilford G-5 emulsions exposed to the 3-Bev Brookhaven synchrotron beam. The experimental data are compared with the Fermi statistical theory and the Peaslee excited-state model. (B.J.H.)

1595
TRANSPORT OF ENERGY BY KNOCK-ON ELECTRONS. J. W. Gardner (Univ. of Sydney, Australia). Proc. Phys. Soc. (London) A68, 1072-7(1955) Nov. 1.

The method of ion pair counting for the determination of the energy loss of ionizing particles is questioned. The assumption of equality for incoming and outgoing knock-on electrons is believed to be a source of error. Effects of this assumption on the average energy loss and the fluctuation of the average are investigated. (D.E.B.)

1596
THE n-p CROSS SECTION IN THE RANGE 60-550 KEV. W. D. Allen and A. T. G. Ferguson (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A68, 1077-9(1955) Nov. 1.

Published experimental values for the n-p cross section in the range 60 to 550 kev deviate as much as 8% from theoretical values. Experimental results of measurements with polythene and graphite indicate that discrepancies arise from incomplete knowledge of attenuating material composition. (D.E.B.)

1597
KINEMATIC SCATTERING OF ELECTRONS BY IDEAL MONOCRYSTALS. B. K. Vaĭnshteĭn. (Inst. of Crystallography). Doklady Akad. Nauk S.S.S.R. 104, 537-9(1955) Oct. 1. (In Russian)

Reflection intensity of monochromatic waves in electron diffraction from a single, ideally formed, kinematically scattering crystal was analyzed. (R.V.J.)

1598
CORRELATION OF POLARIZATION WITH NUCLEON SCATTERING. V. Vladimirskiĭ and Ya. Smorodinskiĭ. Doklady Akad. Nauk S.S.S.R. 104, 713-16(1955) Oct. 11. (In Russian)

Refer also to abstracts 1441, 1442, 1482, 1630, 1632, 1634, and 1635.

RADIATION EFFECTS

1599 KAPL-1403
Knolls Atomic Power Lab., Schenectady, N. Y.
EFFECT OF IRRADIATION ON HOT-PRESSED BORON CARBIDE. W. D. Valovage. Nov. 15, 1955. 45p. Contract W-31-109-Eng-52.

Hot-pressed boron carbide was irradiated in vacuo, in helium, and in sodium to determine the quantity of He released and the physical stability of this material after burnups as high as 36% of the B^{10} atoms. The quantity of He released, in terms of the percentage of generated He, was determined as a function of burnup and temperature. It was found that extensive physical damage occurs, beginning with loss of hardness and cracking after very low burnup and increasing with burnup until complete granulation results after 36% burnup. At each level of burnup investigated, those specimens irradiated in Na were damaged more extensively than specimens in vacuo or in He. (auth)

1600
LUMINESCENCE INDUCED BY RADIATIONS. I. TERNARY AND QUATERNARY SOLUTIONS OF CYCLOHEXANE, BENZENE, p-TERPHENYL, AND OF OXYGEN. Milton Burton, Paul J. Berry, and S. Lipsky (Univ. of Notre-Dame, Ind.). J. chim. phys. 52, 657-66(1955) Sept. (In French)

Carefully deaerated mixtures of cyclohexane and benzene, containing a constant molar fraction of p-terphenyl, were excited by Co^{60} γ rays. The resulting luminescence of the mixture was greater than that which was calculated simply by adding the intensities due to the separate components. The presence of oxygen produces weaker extinction of the luminescence for cyclohexane-terphenyl mixtures than for benzene-terphenyl mixtures. For a volume fraction of benzene less than 0.10, the luminescence intensity falls off according to the predicted values for the components without interaction and reaches a minimum value for a volume fraction of about 0.02. This minimum, appreciably less than the luminescence observed for air saturated cyclohexane-terphenyl solutions, can be interpreted by considerations of heat transfer. (tr-auth)

Refer also to abstracts 1269 and 1270.

RADIOACTIVITY

1601 NYO-6626
Carnegie Inst. of Tech.
SEARCH FOR LONG-LIVED NATURAL BETA RADIOACTIVITIES (thesis). Henry Selig. Nov. 20, 1954. 102p. Contract AT(30-1)-844.

A search was made for natural radioactivity in nuclides which should or might be unstable according to nuclear stability rules or experimental evidence. A large internal-sample proportional counter was used in conjunction with a multichannel pulse analyzer modified for anticoincidence control. The isotopes studied were Ca^{48}, V^{50}, Zr^{96}, Mo^{100}, Cd^{113}, Sb^{123}, Te^{123}, and La^{138}. (B.J.H.)

1602
DISINTEGRATION SCHEMES OF THE Te^{127} AND Te^{129} GROUND STATES. M. C. Day, Jr., G. W. Eakins, and A. F. Voigt (Iowa State Coll., Ames). Phys. Rev. 100, 796-8 (1955) Nov. 1.

A coincidence scintillation spectrometer was used to study the decay of the 9.3-hour Te^{127} isomer and the 72-

minute Te^{129} isomer. The Te^{127} isomer was found to decay by a simple beta ray with an end-point energy of 0.683 ± 0.010 Mev. The beta-ray spectrum of the Te^{129} isomer consists of two beta groups with end-point energies of 1.46 ± 0.01 and 1.01 ± 0.02 Mev. Two gamma rays with energies of 0.450 ± 0.005 and 0.035 Mev were observed, and they were found to be in coincidence. The 0.450-Mev gamma ray was shown to be in coincidence with the 1.01-Mev beta ray, and the 0.035-Mev gamma ray was shown to be in coincidence with the 1.46-Mev beta ray. The results are consistent with level assignments based on the shell model of the nucleus. (auth)

1603

ROTATIONAL STATES IN Tm^{169}. Sven A. E. Johansson (Univ. of Lund, Sweden). Phys. Rev. 100, 835-40(1955)

The decay of Yb^{169} has been investigated by means of a coincidence scintillation spectrometer. Eleven gamma rays have been arranged in a level scheme with levels at 10, 120, 142, 318, 336, 382, and 476 kev. The multipolarity of the strongest gamma rays has been determined and spin values assigned to some of the levels. It is found that five of the levels form a rotational band with $K = {}^{1}/_{2}$. In this case the Bohr-Mottelson unified model predicts an anomalous rotational spectrum. The experimental spectrum agrees very well with the theory. The gamma-ray intensities are discussed and there is a good agreement with the unified model also in this respect. (auth)

1604

SPECTRUM OF INTERNAL BREMSSTRAHLUNG FROM Cr^{51}. S. G. Cohen and S. Ofer (Hebrew Univ., Jerusalem, Israel). Phys. Rev. 100, 856-8(1955) Nov. 1.

Under favorable circumstances, the spectrum of internal bremsstrahlung can be detected from K-capture isotopes decaying with the emission of γ rays. The high-energy part of the ground to ground internal bremsstrahlung spectrum can be detected in Cr^{51}, in the presence of 320-kev γ rays, if suitable precautions to minimize the random superposition of small pulses are taken. A value of 780 ± 50 kev has been found for the energy of disintegration. By using the theoretical expression of Morrison and Schiff for the intensity of the internal bremsstrahlung spectrum, a value of 7% was obtained for the percentage of disintegrations decaying to the 320-kev level of V^{51}. These results are in good agreement with measurements by independent methods. (auth)

1605

DECAY RATES OF C^{14}, N^{14}, AND O^{14}. R. Sherr, J. B. Gerhart, H. Horie, and W. F. Hornyak (Princeton Univ., N. J.). Phys. Rev. 100, 945-6(1955) Nov. 1.

Measurements were made on the decay of O^{14} to the ground state of N^{14}, and on the lifetime of the M1 γ transition from the analog state in N^{14} at 2.31 Mev. Results of both measurements support a theory of the long lifetime of the C^{14} β decay whereby chance cancellation occurs in the matrix element for the decay. (B.J.H.)

1606

THE BETA DECAY OF THE GROUND STATE OF ^{26}Al. M. J. Laubitz (Cavendish Lab., Cambridge, England). Proc. Phys. Soc. (London) A68, 1033-6(1955) Nov. 1.

The β-decay spectrum from the ground state of Al^{26} has been observed by means of a scintillation spectrometer. It has an end point of 1.17 ± 0.05 Mev and corresponds to a second forbidden transition, $\Delta J = 3$, no. The β decay is followed by a γ ray of energy 1.76 ± 0.1 Mev. (auth)

1607

SECONDARY-STANDARD Co^{60} SOURCES PREPARED BY ELECTRODEPOSITION. Paul A. Caldwell and J. D. Graves (Naval Research Lab., Washington, D. C.). Nucleonics 13, No. 12, 49-51(1955) Dec.

The standard sources were prepared by deposition of Co^{60} on a platinum–iridium disk within a rotating-anode electrolytic cell. The Co is then sandwiched between another disk, and the disks are then brazed together around the edges. It is concluded that this method produces satisfactory sources. (B.J.H.)

1608

Pm^{147} POINT SOURCE. John E. Gates and David F. Edwards (Battelle Memorial Institute, Columbus, Ohio). Nucleonics 13, No. 12, 57(1955) Dec.

A point source of Pm^{147} was prepared by electroplating onto the tip of a small diameter wire. The method appears to give satisfactory results. (B.J.H.)

1609

K-AUGER ELECTRONS AND CONVERSION ELECTRONS ACCOMPANYING THE $Co^{57} \xrightarrow{K,\beta} Fe^{57}$ DISINTEGRATION. Jean-Baptiste Bellicard and Andre Moussa. Compt. rend. 241, 1202-4(1955) Oct. 31. (In French)

A study was made of the excited states of Fe^{57} with a double lens β spectrometer. A determination was made of the energies and intensities of the K Auger groups, the K and L conversion rays from the 122 and 136 kev γ rays, and the K, L and M conversion rays of the 14-kev γ ray. (tr-auth)

1610

THE RaC-RaC′ DECAY. Sven A. E. Johansson. Arkiv Fysik 9, No. 6, 561-9(1955). (In English)

The XXX Bi^{214}–Po^{214} decay has been investigated by means of a coincidence scintillation spectrometer. The γ–γ and β–γ coincidence relations have been studied in detail. (auth)

Refer also to abstract 1474.

RARE EARTHS AND RARE-EARTH COMPOUNDS

1611

ELECTRIC EXCITATION OF CERTAIN RARE-EARTH NUCLEI BY PROTONS. Hans Mark and George T. Paulissen (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 100, 813-22(1955) Nov. 1.

Sixteen energy levels have been observed in thirteen isotopes of samarium, europium, gadolinium, and terbium. Electric quadrupole transition probabilities have been determined for some of these energy levels from the measured electric excitation cross sections. For the even-A isotopes of Gd, the properties of the low-lying energy levels are in good agreement with the expectations of the "strong coupling" rotational model. The first energy levels in the even isotopes of samarium show the sharp break in the position of the first excited level which has recently been pointed out by Scharff-Goldhaber. In general, the results are in good qualitative agreement with the predictions of the collective model; however, the moments of inertia for the rotational levels observed in this region are substantially larger than those expected from the intrinsic deformations obtained from the radiative transition probabilities. (auth)

1612
ABSORPTION SPECTRUM AND QUANTUM STATES OF THE PRASEODYMIUM ION. I. SINGLE CRYSTALS OF PRASEODYMIUM CHLORIDE. Edward V. Sayre, Kenneth M. Sancier, and Simon Freed (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 23, 2060–5 (1955) Nov.

The structure of the polarization spectra exhibited by single crystals of anhydrous $PrCl_3$ permitted the assignment of quantum states of the praseodymium ion because of the fact that the symmetry of the crystal fields had previously been determined by x rays. The crystals which were diluted with isomorphic, colorless $LaCl_3$, were grown from melts. Observations of transitions over the range from 2200 to 18 000 A at the temperatures of liquid N_2 and liquid He led to the identification of seven upper states as well as the substates into which they were split by the crystal fields. The four lowest substates of the ground state also were characterized. The F triplet was found inverted. All the transitions were forced electric dipole in nature. (auth)

1613
ABSORPTION SPECTRUM AND QUANTUM STATES OF THE PRASEODYMIUM ION. II. ANHYDROUS PRASEODYMIUM FLUORIDE IN FILMS. Edward V. Sayre and Simon Freed (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 23, 2066–8(1955) Nov.

The absorption spectra of anhydrous PrF_3 were examined to confirm term designations derived from the spectra of anhydrous $PrCl_3$. In the fluoride, Pr ion is at the center of a micro-field of C_{2V} symmetry and in the chloride it is in a field of C_{3h} symmetry. There was complete consistency in the interpretations of the spectra of the two compounds. A new phenomenon appeared in the spectrum of the fluoride, however. The selection rules prohibiting some of the possible transitions of an ion in a field of C_{2V} symmetry valid at the temperature of liquid N_2 were lifted at the temperature of liquid helium, where in fact all possible transitions occurred. There is evidence against any gross crystallographic transformation. It is surmised that the positions of energy minimum for the ions lie slightly off the symmetric positions possibly due to higher order interactions such as occurs in the case of barium titanate. (auth)

1614
ACTIVATION CROSS SECTIONS OF Y^{90} AND Pr^{142}. R. R. Smith and S. D. Reeder (Phillips Petroleum Co., Idaho Falls, Idaho). J. Chem. Phys. 23, 2108–10(1955) Nov.

The irradiation of Y^{89} and Pr^{141} under a sufficiently high thermal neutron flux produces small amounts of Y^{91} and Pr^{142} by secondary neutron capture. A measurement of the second-order activities, although completely unobservable at the end of the irradiation, may be made after the shorter lived first-order activities have disappeared. From relative measurements of the first- and second-order activities induced in Y^{89} and Pr^{141} values for the activation cross sections of Y^{90} and Pr^{142} have been established. For Pr^{142} a value of $\sigma_{act} = 18 \pm 3$ barns was found; for Y^{90} a value of 6.5 barns was established as an effective upper limit. (auth)

SHIELDING

1615
WEIGHT CHANGE IN CYLINDRICAL SHIELDS. David G. Chappell (Knolls Atomic Power Lab., Schenectady, New York). Nucleonics 13, No. 12, 46–7(1955) Dec.

A nomogram is given for the evaluation of weight change in cylindrical shields with diameter changes. (B.J.H.)

SPECTROSCOPY

1616 BM-IC-7725
Bureau of Mines.
CONVERSION TABLES FOR FLUORESCENT X-RAY SPECTROSCOPY. William J. Campbell and John G. Parker. Nov. 1955. 81p.

1617
SPECTROSCOPIC INVESTIGATIONS OF SEPARATED KRYPTON ISOTOPES. Ebbe Rasmussen and Victor Middelboe. Kgl. Danske Videnskab. Selskab. Mat.-fys. Medd. 30, No. 13, 1955. 23p.

The isotopes of Kr were separated by mass spectrograph and the hyperfine spectra analyzed. Tables of transition and shift measurements are given. (D.E.B.)

1618
SPECTRUM AND ENERGY LEVELS OF THE POLONIUM ATOM. E. A. Vernyĭ, A. N. Zaĭdel and K. G. Shvebel'blit. Doklady Akad. Nauk S.S.S.R. 104, 710–12(1955) Oct. 11. (In Russian)

A detailed study of the Po spectrum at 400 to 500°C was made. Discharge of Po vapors was used as the source of light. Registration of spectra in ultraviolet and visible areas was done on a two-meter spectrograph with diffraction grating. Instruments of high dispersion permitted the determination of the wave length of most of the lines with the accuracy up to 0.01 A. (R.V.J.)

THEORETICAL PHYSICS

1619 LA-1940
Los Alamos Scientific Lab., N. Mex.
STUDIES OF THE NONLINEAR PROBLEMS. I. E. Fermi, P. Pasta, S. Ulam, and M. Tsingou. May 1955. 20p. Contract W-7405-Eng-36.

A one-dimensional dynamical system of 64 particles with forces between neighbors containing nonlinear terms has been studied on the Los Alamos computer MANIAC I. The nonlinear terms considered are quadratic, cubic, and broken linear types. The results are analyzed into Fourier components and plotted as a function of time. The results show very little, if any, tendency toward equipartition of energy among the degrees of freedom. (auth)

1620 AEC-tr-2332
SELF-ACCELERATION OF A CHARGE UNDER THE ACTION OF ITS OWN FIELD. M. S. Natanzon. Translated from Zhur. Eksptl'. i Teoret. Fiz. 25, 448–54(1953). 8p. Available from Associated Technical Services (Trans. 03G7R), East Orange, N. J.

Mathematical consideration is given to the possibility of a charge being self-accelerated under the action of its own field. Such an acceleration is found to be impossible. (D.E.B.)

1621 UCRL-Trans-248
THE STABILITY OF THE DEUTERON IN THE MESON THEORY. E. L. Feinberg and D. S. Chernavskiy. Translated by Richard B. Mudge from Doklady Akad. Nauk S.S.S.R. 103, 589–92(1955). 8p.

Equations developed in meson theory led to a study of deuterons as non-relativistic by a method that excluded self-action. Qualitative agreement with experiment is obtained. (D.E.B.)

1622

ON A NEW PHENOMENOLOGICAL THEORY OF SUPERCONDUCTIVITY. Yu. L. Klimontovich (Moscow Inst. of Aviation and Technology.) Doklady Akad. Nauk S.S.S.R. 104, 384-6(1955) Sept. 21. (In Russian)

Clarification of the Hamiltonian corresponding to the equation system of Ginzburg and Landau phenomenological theory (Zhur. Eksptl. i Teoret. Fiz. 20, No. 12 (1950)) and investigation of possible physical interpretation of α and β parameters are discussed. (R.V.J.)

1623

ON CORRELATION PHENOMENA DURING α DECAY. V. M. Strutinskiĭ. Doklady Akad. Nauk S.S.S.R. 104, 524-6 (1955) Oct. 1. (In Russian)

Angular distribution of α particles and $\alpha-\gamma$-angular correlations are calculated. (R.V.J.)

1624

BEHAVIOR OF GREEN'S FUNCTION ELECTRON AT SMALL IMPULSES. V. Z. Blank (Lomonosov State Univ., Moscow). Doklady Akad. Nauk S.S.S.R. 104, 706-9(1955) Oct. 11. (In Russian)

Calculations are made to obtain the asymptotic formula for the electron of Green's function at $k^2 \approx m^2$. (R.V.J.)

1625

GAUGE-INVARIANT FORMULATION OF QUANTUM ELECTRODYNAMICS. P. A. M. Dirac (St. John's Coll., Cambridge, England). Can. J. Phys. 33, 650-60(1955) Nov.

Electrodynamics is formulated so as to be manifestly invariant under general gauge transformations, through being built up entirely in terms of gauge-invariant dynamical variables. The quantization of the theory can be carried out by the usual rules and meets with the usual difficulties. It is found that the gauge-invariant operation of creation of an electron involves the simultaneous creation of an electron and of the Coulomb field around it. The requirement of manifest gauge invariance prevents one from using the concept of an electron separated from its Coulomb field. (auth)

1626

SCATTERING OF MESONS BY NUCLEONS IN THE THEORY OF RADIATION DAMPING. A. S. Martynov (P. N. Lebedev Physical Inst., USSR). Soviet Phys. JETP 1, 68-70(1955) July. (In English). Zhur. Eksptl. ' i Teoret. Fiz. 28, 287-90(1955) Mar. (In Russian)

Use of the theory of radiation damping is made in an attempted qualitative improvement in perturbation theory for the lowest nonvanishing order. A pseudoscalar meson field is chosen and the coupling between the meson field and the nucleon is taken to be a linear combination of pseudoscalar and pseudovector couplings. (D.E.B.)

1627

ON THE THEORY OF ENERGY LOSSES OF CHARGED PARTICLES TRAVERSING A FERROMAGNETIC MATERIAL. D. Ivanenko and V. N. Tsytovich (Moscow State Univ.). Soviet Phys. JETP 1, 135-8(1955) July. (In English). Zhur. Eksptl. ' i Teoret. Fiz. 28, 291-6(1955) Mar. (In Russian)

An investigation of the effect of saturation of the energy losses of a charged particle passing through a ferromagnetic material is presented. An analysis of the separation of the losses into ionization losses and Cherenkov radiation losses is also given. (auth)

1628

QUESTIONS ON QUANTUM FIELD THEORY. II. ELIMINATION OF DIVERGENCES IN SCATTERING MATRIX. N. N. Bogolyubova and D. V. Shirkov. Uspekhi Fiz. Nauk 57, 3-92(1955) Sept. (In Russian)

Divergences in electrodynamics scattering matrix spin of second and third order are calculated. Examples of interacting quantum wave fields and the process of elimination of divergences are described. 22 references. (R.V.J.)

1629

ON QUANTUM MECHANICAL THEORY OF CRYSTALS AT LOW TEMPERATURES. S. V. Vonsovskiĭ (Ural Inst. of Metal Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 447-61(1955) July—August. (In Russian)

1630

PHASE-SHIFT ANALYSIS OF SINGLE-CHANNEL REACTIONS. Harry Lustig (Univ. of Illinois, Urbana) and J. M. Blatt (Univ. of Sydney, Australia). Phys. Rev. 100, 777-90(1955) Nov. 1.

The calculation of phase shifts from experimental data has usually involved "matching" of differential cross-section data at a number of angles equal to the number of assumed nonzero phase shifts, followed by minimization of the errors at other angles. It is possible to derive n simultaneous equations for n assumed phase shifts by calculating n "moments" of a suitable expression for the differential cross section. Such a theoretical expression for the problem of single-channel elastic scattering of charged particles with channel spin $\frac{1}{2}$ has been derived and the integrations performed. For each particular experimental problem, the cross-section data are to be integrated numerically. Then n simultaneous equations are obtained which may be solved for n phase shifts. As an example of this method, proton-alpha scattering data at an incident energy of 5.78 Mev has been analyzed and values for five assumed phase shifts were obtained. (auth)

1631

ELECTRIC MULTIPOLE MOMENTS IN j-j COUPLING. R. D. Lawson (Univ. of California, Berkeley). Phys. Rev. 100, 845-6(1955) Nov. 1.

It is possible to derive a simple expression for the electric quadrupole moment of any l-state arising in j-j coupling, from the proton configuration $(lj)^n$, without explicitly setting up the wave function in question. If the given l-state occurs more than once, only the sum of the quadrupole moments is obtainable by this method. In principle, it is possible to generalize the theory to higher electric multipole moments. (auth)

1632

STATE-VECTOR NORMALIZATION IN FORMAL SCATTERING THEORY. Bryce S. DeWitt (Univ. of California, Berkeley). Phys. Rev. 100, 905-11(1955) Nov. 1.

The familiar problem of state-vector normalization and, in field theories, the related problem of charge renormalization are shown to arise in a natural manner in the formal scattering theory introduced by Lippmann and Schwinger. The mathematical arguments necessary for dealing with these problems are developed entirely within the framework of the formal theory and lead to the customary rules for the construction of the renormalized S-matrix and reactance operator, provided mass renormalization is simultaneously carried out and the one-to-one

correspondence between perturbed and unperturbed eigenstates is set up in a "natural" fashion. (auth)

1633

INTERNAL STRUCTURE OF SPINNING PARTICLES. David Finkelstein (Stevens Inst. of Tech., Hoboken, N. J. and New York Univ., N. Y.). Phys. Rev. 100, 924-31(1955) Nov. 1.

Elementary particle models with internal degrees of freedom have been investigated within the framework of special relativity and orthodox quantum mechanics. Classical arguments indicate that systems whose extensions are $\lesssim$ their Compton wavelength have spin excitation energies $\gtrsim$ their rest mass. The principal aim of this paper is enumeration and classification of particles with rigid internal structure and a useful classification of particle models is by their symmetry groups. In non-relativistic mechanics, this classification shows that there are only the three well-known types of rigid systems that might be labeled by number of degrees of freedom as [0], [2], and [3] and are exemplified by an ideal point, diatomic molecule and rotator, respectively; while of the three types, but one, [3], possesses a spin-$\frac{1}{2}$ state of the Pauli-election type. The corresponding analysis for relativistic mechanics shows there are nine types labeled here [0], [2], [3], [3′], [4], [4′], [4″], [5], and [6], and in addition two one-parameter infinities of types $[3_f]$ and $[5_f]$ $(0 \leq f \leq \pi)$. An algorithm exists for obtaining the spin-spectra of rigid structures from their symmetry groups. Of the $9 + 2^{\infty}$ types, just three ([4], [5], and [6]) possess spin-$\frac{1}{2}$ states of the Dirac-electron type. The apparent rest mass depends upon the internal rotational state of the particle, as is shown by an unrealistic example of a Lagrangian which is an extension of that of the Klein-Gordon particle. (auth)

1634

CROSS SECTIONS AND THE COMPLEX POTENTIAL. C. E. Porter (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 935-6(1955) Nov. 1.

The relation between scattering cross section ratios and the imaginary part of the complex potential has been studied, and expressions for the relation have been derived. (B.J.H.)

1635

MEAN-VALUE CALCULATIONS FOR SPATIAL MULTIPLE SCATTERING. Jean Snover Goldberg and Hartland S. Snyder (Brookhaven National Lab., Upton, N. Y.) and William T. Scott (Smith Coll., Northampton, Mass.). Phys. Rev. 100, 1013-14(1955) Nov. 15.

Calculation of five types of mean values for the spatial (three-dimensional) multiple-scattering theory of Molière and Snyder-Scott is reported: arithmetic mean, half-width, 1/e width, median, and a "Gaussian" width fitted to the zero-angle scattering intensity. The results are expressed in terms of simple interpolation formulas accurate to one percent. (auth)

Refer also to abstracts 1490, 1497, 1499, 1505, 1509, and 1535.

URANIUM AND URANIUM COMPOUNDS

1636 AECD-3663

Argonne National Lab., Lemont, Ill.

QUANTITATIVE DETERMINATION OF ROLLING AND RECRYSTALLIZATION TEXTURES IN 600°C- AND 300°C-ROLLED URANIUM RODS. Warren P. Chernock and Paul A. Beck. Aug. 1951. Partially revised June 1952. Decl. with deletions Apr. 25, 1955. 38p. Contract W-31-109-eng-38.

The rolling and recrystallization textures in 300 and 600°C-rolled uranium rods were investigated employing a Geiger counter spectrometer and a modification of the Schulz reflection technique. The method used minimizes the errors resulting from limitations of the Schulz technique. The rolling textures were found to consist of two fiber texture components, in which the (010) and the (110) planes are perpendicular to the rod axis. The relative amount of the (110) texture increases with increasing rolling temperature. The recrystallization texture of a rod having mainly the (010) rolling texture consists of the (010) and the (140) fiber texture components. (auth)

1637 ANL-5367

Argonne National Lab., Lemont, Ill.

DEFORMATION MECHANISMS OF ALPHA-URANIUM CRYSTALS. Final Report—Metallurgy Program 4.1.7. Metallurgy Div. L. T. Lloyd and H. H. Chiswik. Dec. 14, 1954. 100p. Contract W-31-109-Eng-38.

The operative deformation elements in α-uranium single crystals under compression at room temperature have been determined as a function of the compression directions. The deformation mechanisms noted may be arranged with respect to their frequency of occurrence and ease of operation in the following order: (a) (010)−[100] slip; (b) {130} twinning; (c) ~ {172} twinning; and (d) under special conditions of stress application ~{176} twinning, {011} slip, cross-slip, and kinking. The composition planes of the {172} and {176} systems were found to be irrational. Cross-slip was shown to be associated with the major (010) slip system, coupled with localized interaction of slip on the (001) planes. The mechanism of kinking was found to be similar to that observed in other metals, in that it occurred chiefly when the compression direction was nearly parallel to the principal slip direction [100], and was associated with a lattice rotation about an axis contained in the slip plane and normal to the slip direction direction—the [001] in the U lattice. The resolved critical shear stress for slip on the (010)−[100] system was found to be 0.34 kg per mm^2. In a single test it was shown that under compression in suitable directions twinning on the {130} also occurs at 600°C. (auth)

1638 HW-38912

Hanford Atomic Products Operation, Richland, Wash.

THE MELTING OF SMALL PIECES OF URANIUM METAL. W. R. DeHollander. Sept. 1, 1955. 8p. Contract W-31-109-Eng-52.

A method of melting small pieces of uranium was developed. A reducing atmosphere of metallic calcium, together with a solvent flux such as fused barium chloride, is required. The calcium reduces the uranium oxide skull and permits the metal drops to coalesce. The entire melt is performed under argon gas. (auth)

1639 KAPL-62

Knolls Atomic Power Lab., Schenectady, N. Y.

REPORT OF AN ORIENTATION STUDY ON ROLLED AND EXTRUDED RODS OF α-URANIUM. Beulah F. Decker. Apr. 20, 1948. Decl. Nov. 15, 1955. 6p. Contract W-31-109-Eng-52.

An orientation study with x rays has been made of samples of rolled α-uranium and extruded α-uranium. A

new method was tried wherein a Geiger counter spectrometer trace was made of a transverse section of the rod and another of a longitudinal section. Only planes normal to the axis of the rod are effective in the transverse section trace, and only planes parallel to the axis of the rod in the longitudinal section trace. If one assumes randomness in directions normal to the axis of the rod, an evaluation of orientation may be made from a consideration of the line absences on the two traces. The results show that a (110) plane is normal to the axis of the rod (with an orientation spread of ±30°). This places the [100] and [110] directions at positions approximately 30° from the rod axis. (auth)

1640 LAMS-1892

Los Alamos Scientific Lab., N. Mex.

RADIATION INTENSITY FROM SPHERES OF U^{233} CONTAMINATED WITH U^{232}. J. J. Devaney. Feb. 1955. Decl. Sept. 19, 1955. 4p. Contract W-7405-ENG-36.

The γ ray intensity at the surface versus time was calculated for spheres of U^{233} of various radii contaminated with U^{232} and having a 0.003 in. Ni covering. (C.H.)

1641 NYO-3919

Tufts Coll., Medford, Mass.

THE DISSOCIATION PRESSURE AND THE NATURE OF URANIUM HYDRIDE AND THE PREPARATION OF TRANSITION METAL HYDRIDES, PART II: PAPER 1. DISSOCIATION PRESSURE STUDIES OF URANIUM HYDRIDE. George G. Libowitz; PAPER 2. URANIUM HYDRIDE STUDIES. Edward J. Goon; PAPER 3. THE PREPARATION OF TRANSITION METAL HYDRIDES. M. John Rice, Jr. Mar. 17, 1955. 35p. Progress Report on the Preparation and Properties of Metal Hydrogen Systems, Contract AT(30-1)-1355.

Dissociation Pressure Studies of Uranium Hydride. Dissociation pressure-composition isotherms for the U–H_2 system are presented for hydrogen compositions ranging from n = 0 to n = 3, and temperatures ranging from 435 to 635°C. The most striking property of these isotherms is the slope observed in the "plateau" region. Comparisons are made between the present results and extrapolations of the work done by previous investigators at lower temperature. Heats of formation and solution are calculated from log P vs. 1/T curves. Uranium Hydride Studies. Apparatus for taking x-ray-diffraction patterns of uranium hydride at high pressures (550 psi) and high temperatures (500°C) has been assembled. At 500° ± 3°C the primitive cubic structure of UH_3 exists down to pressures of 130 psi hydrogen and the expanded form of α-uranium exists at pressures of 90 psi or lower. Samples of $UH_{2.78}$ and $UH_{2.36}$ were heated at temperatures up to 250°C for varying periods, and the density, hydrogen content, and diffraction patterns measured. The hydriding of a sample of uranium metal in the microscope hot-stage was observed while the temperature of the metal was slowly raised to 225°C and the pressure remained about one atmosphere hydrogen. Preparation of Transition Metal Hydrides. Reactions of $NiBr_2$, $CoBr_2$, $FeCl_3$, and $MnCl_2$ with ethereal solutions of AlH_3 are described together with cursory experiments on the reaction of $LiAlH_4$ with the metal halides. (auth)

1642 ORNL-1992

Oak Ridge National Lab., Tenn.

A DIRECT COMPARISON OF SOME NUCLEAR PROPERTIES OF U-233 AND U-235. J. T. Thomas, J. K. Fox, and Dixon Callihan. Dec. 12, 1955. 25p. Contract W-7405-eng-26.

A comparison has been made of some nuclear properties of U^{233} and U^{235} based on data obtained in a series of critical experiments. Aqueous solutions of uranyl oxyfluoride containing uranium enriched to about 90% in each of the two isotopes have been made critical in water reflected spherical reactors having diameters of 26.4 and 32.0 cm. With the hypotheses that the reported nuclear constants for U^{235} are reliably known and that the neutron leakage spectra for U^{233} and U^{235} were equal for the same water reflected critical sphere, the value of $\eta(U^{233})$ at 0.026 ev was determined to be 2.31 ± 0.03. The critical masses of the two isotopes have been measured over a limited temperature range and corresponding values of the reactivity temperature coefficient are reported. The results are tabulated. The critical mass of U^{233} in the larger sphere, unreflected, was 1.15 kg. The delayed neutron yield of the two isotopes were compared by noting the periods resulting from the withdrawal of a boron poison from the critical spheres. It is shown that the yield from U^{233} is about one third that from U^{235}, in agreement with other determinations. (auth)

1643 AEC-tr-2338

MICROGRAPHIC ASPECTS OF POLYGONIZATION IN URANIUM. Marcel L. Englander and Pierre A. Jacquet. Translated by K. S. Bevis from Compt. rend. 237, 262-4 (1953). 3p.

Micrographic examinations of U sample indicate that polygonization is accentuated in a larger number of grains when the U has been subjected to various specific heat treatments in the α phase, with or without pressure. (C.W.H.)

1644 AEC-tr-2339

OBSERVATION OF POLYGONIZATION IN URANIUM BY X-RAY DIFFRACTION. Adrienne R. Weill and Pierre A. Jacquet. Translated by K. S. Bevis from Compt. rend. 237, 1002-3(1953). 3p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-701.

1645 AEC-tr-2340

METALLOGRAPHIC STUDY OF INCLUSIONS OF URANIUM HYDRIDE IN METALLIC URANIUM. H. Mogard and G. Cabane. Translated by K. S. Bevis from Rev. met. 51, 617-23(1954). 10p.

The experimental procedures used to study the inclusions of uranium hydride in metallic U are discussed in detail, and characteristics of the inclusions are described. A proposed model for a U–H equilibrium diagram is also given. (B.J.H.)

1646 AEC-tr-2341

RECRYSTALLIZATION OF URANIUM AFTER PASSING THROUGH THE TRANSFORMATION POINTS. M. Pruna, P. Lehr, and G. Chaudron. Translated by K. S. Bevis from Rev. met. 51, 589-97(1954). 12p.

The effects of transformation temperature on the structure and texture of uranium are considered. The uranium sample was examined using the following methods: differential dilatometric thermal analysis in vacuo; the micrographic study under polarized light of electrolytically polished surfaces; and, Laue diagrams of large crystals obtained after the sample passed through the transformation. (R.V.J.)

1647 AEC-tr-2342

ORIENTATION OF THE CRYSTALS IN ROLLED URANIUM. A. Winogradski. Translated by K. S. Bevis from Rev. met. 51, 597-603(1954). 6p.

A photographic method using x rays diffracted at small Bragg angles was used to study the crystalline texture of rolled U. The experimental technique is discussed in detail and resultant microradiographs are shown. (B.J.H.)

1648 AEC-tr-2345

METALLOGRAPHIC STUDY OF THE $\beta \rightarrow \alpha$ TRANSFORMATION OF URANIUM IN STABILIZED URANIUM–CHROMIUM ALLOYS. W. R. Mott and H. R. Haines. Translated by K. S. Bevis from Rev. mét. 51, 614-16(1954). 5p.

An investigation of the transformation characteristics at ambient temperature of alloys quenched in the β phase has been undertaken. A microscope employing polarized light is particularly well adapted to this study since the α and β phases are both anisotropic. Because the anisotropy is more pronounced in the α phase, the two phases can be readily distinguished in polarized light. (tr-auth)

1649

ON THE EXPANSION BEHAVIOR OF SINGLE CRYSTALS OF α URANIUM. Pierre Lehr and Jean-Paul Langeron. Compt. rend. 241, 1130-3(1955) Oct. 24. (In French)

The expansion behavior of uranium monocrystals was studied as a function of their orientation, and values of linear expansion coefficients along the three principal crystal axes were determined. (tr-auth)

1650

NEUTRON-INDUCED FISSION CROSS SECTIONS OF U^{234} AND U^{236}. R. W. Lamphere (Oak Ridge National Lab., Tenn.) and R. E. Greene (Union Carbide Nuclear Co., K-25 Plant, Oak Ridge, Tenn.). Phys. Rev. 100, 763-70(1955) Nov. 1.

The fission cross sections of the uranium isotopes, 234 and 236, have been measured from their thresholds to 4.0-Mev neutron energy by use of neutrons from the $T(p,n)He^3$ reaction. Neutron energy spread varied from 60 to 100 kev for most points. U^{234} has a threshold at about 300 kev, rises to 1.24 barns at 850 kev, dips to 1.08 barns at 1.06 Mev, rises to 1.47 barns at 1.9 Mev, dips to 1.40 barns at 2.4 Mev, and then rises to 1.55 barns at 4.0 Mev. Variations in between these points appear smooth with the energy spread present in the neutron beam. Similarly, U^{236} has a threshold at about 670 kev, rises, to 0.36 barn at 970 kev and remains nearly constant to 1.04 Mev when it again rises, reaching 0.75 barn at 1.4 Mev, falling to 0.66 barn at 1.56 Mev, rising to 0.89 barn at 2.5 Mev, falling to 0.87 barn at 2.7 Mev, and then rising to 0.99 barn at 4.0 Mev. The thresholds referred to are the energies at which the cross sections are only about 1% of their values on the relatively flat portion of the curve between 2 and 3 Mev. Results are believed to be accurate to 6.0%. (auth)

Refer also to abstract 1233.

PATENTS

CHEMISTRY

1651

LABORATORY HOOD. A. D. Mackintosh and T. W. Hungerford (to U. S. Atomic Energy Commission). U. S. Patent 2,715,359, Aug. 16, 1955.

Chemical hoods of a cabinet type having substantially uniform air requirements are described which are suitable for general use in chemical laboratories including both radiochemical use and cold operations. The important features are as follows: the provision of a work surface slanting rearwardly to a drain in order to facilitate cleaning and decontamination; the provision of doors movable horizontally for reducing the open space of the hood; and the provision of an air by-pass synchronized for closing with the opening of the hood to overcome drafts or rushes of air through the working space. (auth)

1652

METHOD OF PRODUCING ZIRCONIUM HALIDE. I. E. Campbell. (to U. S. Atomic Energy Commission). U. S. Patent 2,716,051, Aug. 23, 1955.

Zirconium tetraiodide has been prepared from zirconium carbonitride by first treating the carbonitride with I_2 vapor in a static atmosphere, at temperatures ~1000°C, for ~2 hr and then passing an I_2 vapor stream over the carbonitride at temperatures >1000°C. (C.W.H.)

1653

METHOD OF PREPARING K_2UF_6 FOR FUSED BATH ELECTROLYSIS. R. Nagy and J. W. Marden (to U. S. Atomic Energy Commission). U. S. Patent 2,717,234, Sept. 6, 1955.

Dipotassium uranous fluoride, K_2UF_6, which is useful in the production of uranium metal by electrolysis of a fused electrolyte, is produced by reacting UO_2 with KHF at a temperature of about 800°C to form the K_2UF_6 and KF. The molten mixture is permitted to stratify following which the product layer of K_2UF_6 is separated from the KF. (auth)

1654

SEPARATION OF FISSION PRODUCTS BY ADSORPTION FROM ORGANIC SOLVENTS. J. Schubert (to U. S. Atomic Energy Commission). U. S. Patent 2,717,696, Sept. 13, 1955.

Fission product rare earths may be separated from neutron irradiated uranium by contacting an organic solvent solution, containing dissolved rare earths and U values, with a siliceous adsorbent, whereby the rare earth values are adsorbed leaving the U in solution in the organic solvent. (auth)

1655

REMOTE CONTROL APPARATUS FOR TRANSFERRING FLUIDS. M. C. Leverett, F. R. Ward, and J. T. Weills (to U. S. Atomic Energy Commission). U. S. Patent 2,718,459. Sept. 20, 1955.

A remote control apparatus has been designed for transferring radioactive or other materials including solutions from one reactive vessel to another. It accomplishes removal of these materials from any one or more of a series of containers, and has an indicator for informing the operator when any particular container under consideration has been emptied or is filled. Compressed air or suction is employed for transferring the contents of the containers from one to another. (auth)

1656

PROCESS AND APPARATUS FOR PROTECTING URANIUM HEXACHLORIDE FROM DETERIORATION AND CONTAMINATION. D. Lipkin and S. I. Weissman (to U. S. Atomic Energy Commission). U. S. Patent 2,719,777. Oct. 4, 1955.

The protection of UCl_6 from deterioration and contamination is achieved by introducing the material into a hermetic container having interior surfaces fabricated of a Ni alloy, such as Monel or Inconel, and hermetically sealing said container. (auth)

1657
METHOD OF SYNTHESIZING NUCLEOSIDES AND ANALOGOUS COMPOUNDS AND COMPOUNDS PREPARED THEREBY. J. Davoll and G. B. Brown (to U. S. Atomic Energy Commission). U. S. Patent 2,719,843. Oct. 4, 1955.

Glycosyl derivatives of heterocyclic compounds containing an unsubstituted cyclic imino group may be synthesized by reacting the imino compound with an acylglycosyl halide in a heated inert solvent to substitute the acylglycosyl radical for the halomercuric radical on the imino nitrogen. (auth)

ENGINEERING

1658
POLYETHYLENE COATING AND METHOD OF APPLYING THE SAME. R. A. Wiese (to U. S. Atomic Energy Commission). U. S. Patent 2,716,075, Aug. 23, 1955.

A method is outlined for applying a strongly adherent, impermeable chemically resistant coating of polyethylene to the surface of structural materials, such as concrete, and consists of successively applying thin layers of the following materials in the order named: a solvent deposited phenolic resin coating; a flame sprayed coating of polyethylene containing a mineral filler such as finely divided silica; and a flame sprayed coating of essentially pure, inert polyethylene. (auth)

1659
SUPPORT FOR A TUBE CUTTING DEVICE. P. E. Lowe and H. J. Bellarts (to U. S. Atomic Energy Commission). U. S. Patent 2,716,530, Aug. 30, 1955.

Supporting apparatus were constructed for pipe cutting devices for severing a tube in a location unfit for human occupancy, such as within a boiler or other device where temperature or other conditions present a health hazard. This device may be readily positioned by remotely operated means and controlled at a remote location. (auth)

1660
LIQUID METAL HIGH PRESSURE PUMP. L. B. Vandenberg (to U. S. Atomic Energy Commission). U. S. Patent 2,716,943, Sept. 6, 1955.

An electromagnetic liquid-metal pump capable of economically producing a high pressure head and low flow has been developed. Pumping is accomplished by creating a radial magnetic field either by use of permanent magnets or by causing an electric current to flow through a series of coils arranged to create a radial magnetic field in the body of the pump. After passing through the coils, the current enters the inlet for the liquid metal pump and furnishes the armature current therefor. As a result of interaction between the current in the liquid metal and the radial magnetic field set up by the coils, the liquid metal is caused to flow in a spiral path through the pump, each turn of the spiral acting as a pump in series with pumps formed by preceding spirals. (auth)

1661
RECIPROCATING MOTOR CONTROL FOR AUTOMATIC CUT-OFF APPARATUS. C. S. Presenz (to U. S. Atomic Energy Commission). U. S. Patent 2,719,941. Oct. 4, 1955.

A cutting tool has been adapted to continuously and automatically cut selected standard lengths of wire, ribbon, tape, rod, or the like. The wire is threaded from a magazine through a splice or know detector, through a guide and tension attachment, through driven rollers, to a solenoid cut-off arrangement which is actuated by a thyratron variable control circuit. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

1662
APPARATUS FOR PRODUCTION OF PURIFIED METALS. Z. M. Shapiro (to U. S. Atomic Energy Commission). U. S. Patent 2,717,915. Sept. 13, 1955.

An improved apparatus has been developed for the purification of metals by thermal decomposition of the halide. (auth)

PHYSICS

1663
ION SOURCE FOR CALUTRONS. E. O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent 2,715,682, Aug. 16, 1955.

An ion source for a calutron has been modified so that the total number of electrical leads is reduced. This is accomplished by providing an E shaped cathode comprised of a back portion with three legs projecting therefrom. The back portion of the cathode is located adjacent an arc block comprised of individual arc chambers in such a manner that electrons are emitted into the various chambers from different sections of the back portion of the E shaped cathode. Current is supplied to each of the aforesaid legs of the cathode for heating the back portion to an electron emitting temperature and control means are connected to the three legs so that the electron emission from each section of the back portion may be regulated. In this manner one cathode is made to serve a plurality of arc chambers. (auth)

1664
ION SOURCE FOR A CALUTRON. J. G. Backus and B. Peters (to U. S. Atomic Energy Commission). U. S. Patent 2,715,683, Aug. 16, 1955.

An important feature of this ion source for a calutron resides in the combination of a diaphragm closing one side of the arc chamber and having an elongated slit disposed in register with a similar slit in a second diaphragm mounted closely adjacent the first diaphragm and maintained at a highly negative potential with respect thereto. Another feature of the ion source resides in disposing the accelerating electrode adjacent the bottom of a cup shaped depression formed in one wall of the arc block. This prevents the random escape of ions from the arc chamber and increases the efficiency of the ion source in that substantially all of the ions formed in the arc chamber are drawn into the beam. A further feature resides in a cylindrical shield encompassing the arc block, providing support for the accelerating electrode, and provided with means whereby the shield may be displaced laterally with respect to the arc block in order that the slit in the accelerating electrode may be registered with the slit in the diaphragm closing the wall of the arc chamber. (auth)

1665
ION PRODUCING APPARATUS. A. B. Cardwell (to U. S. Atomic Energy Commission). U. S. Patent 2,715,692, Aug. 16, 1955.

An improved ion source is designed for a calutron wherein

the stability and uniformity of the ionizing arc is increased by the introduction of an additional gas into the electron stream, thus providing additional positive ions to support the discharge and neutralize the space charge of the electrons. In this manner a steady ionizing arc can be obtained in an ionization chamber which is run colder and at a lower charge vapor pressure. This reduces charge consumption and gunking or depositing of charge material on portions of the unit and provides a steady uniform positive ion beam. By injecting the additional gas into the electron stream at a point at and around the filamentary cathode, deterioration of the filamentary cathode may be greatly inhibited. Preferably, for this purpose the additional gas employed is of a low atomic weight so that bombardment of the cathode by positive ions of the additional gas will be less effective in eroding the cathode than bombardment by positive ions of the charge material. (auth).

1666

DEEP COLLIMATING SLOT. S. M. MacNeille and K. R. MacKenzie (to U. S. Atomic Energy Commission). U. S. Patent 2,715,693, Aug. 16, 1955.

An improvement has been made in the ion source unit wherein a thickened plate with a deep defining slot therein replaces the conventional thin plate defining slot. This reduces the back flow of ions from the ionization chamber through the defining slot to the cathode. These highly accelerated ions had been striking the cathode at high velocities to decrease the life of the cathode. The substitution of a deep defining slot for the conventional slot in a thin plate permits the neutralization of these ions before they strike the cathode. (auth)

1667

ION PRODUCING APPARATUS. H. P. Yockey (to U. S. Atomic Energy Commission). U. S. Patent 2,715,694, Aug. 16, 1955.

An ion source for calutrons is described wherein the stability and uniformity of the ionizing arc is improved by the introduction of an auxiliary gas into the electron stream at the anode end thereof, thus providing additional positive ions to support the discharge and to neutralize the space charge of the electron stream. In this manner, a steady ionizing arc can be obtained in an ionization chamber which is run colder and at a lower charge vapor pressure than was heretofore required. (auth)

1668

ION PRODUCING MECHANISM. J. A. DeJuren (to U. S. Atomic Energy Commission). U. S. Patent 2,715,695, Aug. 16, 1955.

An ion source is modified wherein the conventional arc defining slot opposite the cathode is provided with a constricted central portion. This permits passage of electrons which define an arc of substantially uniform ion density. The slot actually has opposed curved walls, one of which is of flatter curvature than the other and positioned with respect thereto to define a central constriction. (auth)

1669

ELECTRICAL SWITCH. F. R. Shonka (to U. S. Atomic Energy Commission). U. S. Patent 2,716,168, Aug. 23, 1955.

An electrical switch is described which is adapted to be used in a radiation dosimeter. It provides a mechanically simple and durable switch which is effective to make and break metallic electrical contact within a sealed ionization chamber and may be operated wholly from the exterior of the sealed chamber. The purpose of the switch being to physically separate an electrode of the ionization chamber from its terminal on the outer surface of the casing to prevent leakage due to moisture between the contacts. (auth)

1670

PULSE GENERATOR. (to U. S. Atomic Energy Commission). D. A. Mack. U. S. Patent 2,716,194, Aug. 23, 1955.

A square wave pulse generator having extremely fast rise time output has been developed. It is comprised of a power supply, a section of charging cable, and a conventional, mercury relay. It develops pulses having a rise time of substantially 1×10^{-9} second and it substitutes conventional element components for gaseous discharge tube elements. (auth)

1671

ION SOURCE. R. J. Jones and R. E. Wright (to U. S. Atomic Energy Commission). U. S. Patent 2,716,197, Aug. 23, 1955.

An improved source of ions for a cyclotron has been tested. It provides an intense arc inside an elongated and enclosed chamber, through which arc all molecules of the gas to be ionized must pass before reaching the arc chamber. Electrodes are provided outside a long narrow slit in the chamber to draw ions out of the chamber and to focus and define the beam before it enters the cyclotron. (auth)

1672

THYRATRON TRIGGER CIRCUIT FOR DISCHARGING A CAPACITOR. E. A. Aas (to U. S. Atomic Energy Commission). U. S. Patent 2,716,211, Aug. 23, 1955.

An improved electrical trigger circuit capable of repetitively deriving strong current pulses of long duration is discussed. This is accomplished by a circuit in which a large condenser is charged quickly through a low impedance and when desired is slowly discharged through a second path consisting of a gaseous device and a load. During this discharge the former low charging impedance is changed to a high impedance so that gaseous conduction will cease at the end of discharge. (auth)

1673

LEAK DETECTOR. R. F. Wehrmann and E. W. Rebol (to U. S. Atomic Energy Commission). U. S. Patent 2,716,229, Aug. 23, 1955.

An electrical indicating system is described for detecting expansion of confined bodies, such as, initial swelling of jacketed U bodies, in order that they may be removed before the swelling has progressed to the point where removal of the bodies from the cooling water tube becomes difficult or impossible. This is accomplished by placing an elongated contactor between the cooling water tube and the jacketed U bodies. Any swelling of a U body will exert a force on the contactor to complete an electrical circuit and energize a suitable alarm. (auth)

1674

DEVICE FOR COUNTING ALPHA AND BETA PARTICLES. G. E. Driver (to U. S. Atomic Energy Commission). U. S. Patent 2,716,523, Aug. 30, 1955.

A device for separating pulses of different amplitudes for the purpose of measuring alpha and beta particles simultaneously is designed. The detector takes advantage of the well known fact that alpha particles radiate pulses of much greater amplitude than beta particles in the same tube. The discrimination is accomplished by means of two multivibrator tubes, one of which is triggered only by alpha particles and the other being triggered by both alpha and beta particles, in addition to other tube circuits. (auth)

1675

RADIATION SHIELD. W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent 2,716,705, Aug. 30, 1955.

A radiation shielding arrangement which is suitable for use in connection with nuclear reactors is described. The shielding comprises a pair of spaced layers of concrete, a plurality of spaced layers of paraffin, disposed between the layers of concrete, and a plurality of layers of paraffin intermixed with steel shot disposed between the layers of paraffin. (auth)

1676

PULSE LIMITER AND SHAPER. R. Madey (to U. S. Atomic Energy Commission). U. S. Patent 2,717,316, Sept. 6, 1955.

A circuit for limiting and shaping the output pulses of a photomultiplier tube is described. The chief advantage is that the resolving time or "dead time" of the circuit has been substantially improved and a simpler, less costly device has been provided, by reducing the number of tubes required to a single tube and achieving the discharge of circuit distributed and interelectrode capacitances by utilizing a section of coaxial cable suitably connected to the anode circuit of the photomultiplier tube. This latter connection also serves to render the circuit sensitive to consecutive pulses corresponding to light scintillations of differing magnitude, as where a small scintillation occurs after a large one but within the decay time of the latter. (auth)

1677

PRECISION REGULATED POWER SUPPLY. C. Sewell, Jr., and D. M. Button (to U. S. Atomic Energy Commission). U. S. Patent 2,717,353, Sept. 6, 1955.

A regulated power supply having an output direct voltage fluctuation of less than 15 ppm is designed. The power supply responds to the difference between a standard voltage and variations in a part of the load voltage. It stabilizes the direct voltage output not only in respect to changes in load voltage, but also in spite of drift caused by contact potentials in the tubes of the power supply, changes in the input line voltage, and changes in voltage of a secondary reference. The result is accomplished by employing a standard cell as a first reference voltage and a direct current amplifier for amplifying any difference in voltage between a selected part of the output voltage and the reference voltage. (auth)

1678

ELECTRIC DISCHARGE DEVICE. F. Oppenheimer (to U. S. Atomic Energy Commission). U. S. Patent 2,719,925. Oct. 4, 1955.

A calutron ion source has been modified, utilizing an improved arrangement for defining the cross-section of the arc discharge between the main electrodes. It provides an electrically stable arc discharge having substantially uniform ionization over any cross-section. It is comprised of an electron emitter and anode disposed within an arc block wherein the novelty resides in an apertured electrode positioned between the emitter and the anode. The opening of the electrode is less than the emitting portion of the emitter whereby a selected part only of the electron emission may be projected in to the arc region. (auth)

1679

ARC DISCHARGE DEVICE. W. M. Burbaker (to U. S. Atomic Energy Commission). U. S. Patent 2,717,963. Sept. 13, 1955.

A modified calutron ion source is described. It provides an electron source arrangement of the indirectly heated cathode type wherein the arc cathode is heated by electron bombardment and a major part of the electrical energy is derived from an alternating source. The electron emission of the arc cathode may be easily regulated and varied, and the electrodes constituting the improved electron source are subjected to minimum wear. A grid electrode which may be biased with respect to the arc cathode is provided. This grid electrode, in conjunction with the use of alternating current, permits reduction of electron bombardment of the filamentary cathode and enables the electron bombardment of the arc cathode to be easily controlled. (auth)

1680

SULFUR CRYSTAL COUNTER. V. L. Parsegian and R. C. Maninger (to U. S. Atomic Energy Commission). U. S. Patent 2,717,964. Sept. 13, 1955.

A sulfur crystal counter has been developed for the detection of radioactive particles, and is composed of a polycrystalline sulfur film, two electrically conductive electrodes contiguous with the sulfur film, means for establishing a potential difference between the electrodes and means for measuring current flow between the electrodes. (auth)

1681

VALVE DEVICE FOR ISOTOPE SEPARATING APPARATUS. P. J. Galbreath and W. C. Tunnell (to U. S. Atomic Energy Commission). U. S. Patent 2,718,235. Sept. 20, 1955.

A valve device for regulating the ion source in an isotope separating apparatus is discussed. It is comprised of a container having an opening therein forming a valve port, a valve cooperable therewith and forming a closure for the container, an enclosure surrounding the container and having a valve at one end operably connected to the first valve so that the entire unit is removable. (auth)

1682

CHARGE RECEPTACLES FOR USE IN ION SOURCE UNITS. D. C. Sewell (to U. S. Atomic Energy Commission). U. S. Patent 2,719,233. Sept. 27, 1955.

Charge receptacles are described for use in ion source units of calutrons. It embodies an improved closure arrangement facilitating ready opening of the charge receptacle. With this modification, the cover may be removed without physical contact therewith. (auth)

1683

NEUTRONIC REACTOR RADIATION INDICATOR. W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent 2,719,823. Oct. 4, 1955.

A neutron density indicator is designed for operation over the wide ranges encountered in the normal operation of a neutronic reactor. This is accomplished by employing a movable exploratory element arranged to move within a passageway extending through the main reactor shield in such a manner that increasing thicknesses of the shield are interposed between the exploratory unit and the reactor core as the unit is moved along this passageway. This arrangement permits the use of a neutron density indicating means of sufficiently high sensitivity to take care of starting operations and requires only the determination of the proportionality factor introduced by the shield to permit its use at any higher neutron density encountered during operation of the reactor. (auth)

1684

MAGNETIC SHIMS. J. R. Oppenheimer, S. P. Frankel and E. C. Nelson (to U. S. Atomic Energy Commission). U. S. Patent 2,719,924. Oct. 4, 1955.

Calutron improvements have been made which provide for an increase in the sharpness of focus of the ion beams without restricting or confining the beam at the source to a

small angular spread. This is accomplished by modifying the magnetic field by means of shims of magnetic material which distort the otherwise homogeneous magnetic field and thereby effects changes in the ion paths. Consequently the beam envelope is also changed in a manner calculated to result in a narrowed beam pattern or image at the target. (auth)

1685

ELECTRIC DISCHARGE DEVICES. L. F. Wouters (to U. S. Atomic Energy Commission). U. S. Patent 2,717,962. Sept. 13, 1955.

An electric discharge device has been utilized as a calutron ion source. This improved ion source includes a filamentary cathode, a plate-like arc cathode, and a control electrode arranged in alignment with the magnetic field of the calutron, the arc cathode being positioned immediately above a collimating electrode of the ion source arc chamber, which chamber contains a vapor through which an arc discharge is established. (auth)

1686

RADIATION SHIELD BLOCK. J. O. Billups (to U. S. Atomic Energy Commission). U. S. Patent 2,720,105. Oct. 11, 1955.

Radiation shield blocks and building walls constructed therefrom provide a structurally interlocking building block for erecting temporary structures useful in laboratory areas for the storage of materials emanating harmful radioactivity. The blocks can be rapidly and repeatedly assembled and disassembled without the use of mortar or similar structural ties and a single building block is capable of assembly in different ways to make a continuous wall or corners. These blocks are suitable for other uses dependent upon the material of their composition. (auth)

1687

SCINTILLATION-TYPE ION DETECTOR. P. I. Richards and E. E. Hays (to U. S. Atomic Energy Commission). U. S. Patent 2,720,593. Oct. 11, 1955.

A scintillation-type ion detector has been used for detecting moving charged particles in the presence of an intense magnetic field. It is comprised of an elongated translucent member having one end located in the magnetic field containing the moving charged particles to be detected. A high accelerating potential is applied near this end of the member to attract the charged particles thereto. A substance that will luminesce when the charged particles impinge thereon is coated on the end of the translucent member. The photons resulting from the luminescence are transmitted through the translucent member and outside of the magnetic field where they are detected and amplified by a photomultiplier tube. (auth)

1688

REGULATED LOW VOLTAGE POWER SUPPLY. W. H. Deuser (to U. S. Atomic Energy Commission). U. S. Patent 2,720,622. Oct. 11, 1955.

A power supply of a unidirectional voltage having a substantially zero ripple component in the output voltage is developed. It provides a low voltage power supply for mass spectrometers and electron microscopes which overcomes the limiting features of presently available low voltage power supplies by providing an extremely well regulated output voltage. The stable operation is obtained in part by applying the regulated output voltage as the heater voltage of a regulating tube and a portion of such output voltage as a cathode bias to be balanced against a standard grid bias of the regulating tube. (auth)

1689

CALUTRONS. E. O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent 2,721,272. Oct. 18, 1955.

The track assembly of a calutron is composed of a plurality of substantially fluid-type tanks, magnetic field structure associated with these tanks and arranged to set up a magnetic field therethrough, a header associated with the tanks together with valve means for selectively connecting the tanks to the header, means for evacuating the header, a plurality of transmitters disposed in the tanks for transmitting a plurality of ion beams through the magnetic field, and a plurality of receivers disposed in the tanks to receive the ion beams. By this arrangement of the tanks and magnetic cores great economy of space is realized; the isotope separating capacity is increased in the order of 16 times that of a conventional calutron although the overall dimensions and the vacuum pumping equipment are only somewhat larger; and the common equipment may be operated continuously in spite of the fact that one or more of the individual tanks may be removed from operation for adjustment or repair. (auth)

1690

BEAM CURRENT INTEGRATOR. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,721,699. Oct. 25, 1955.

A beam current integrator for a calutron is described which utilizes the gain of a vacuum tube to keep the collector voltage variations much smaller in magnitude than would be the case in a conventional integrator using a condenser, a glow tube, and a register. Thus the potential of the collecting electrode is maintained constant while the summation of the beam current over a given time interval is obtained. (auth)

1691

BEAM CURRENT INTEGRATOR. R. DeLiban and W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,721,700. Oct. 25, 1955.

A beam current integrator for a calutron has been developed which utilizes the gain of a multistage amplifier to keep the collector voltage variations much smaller in magnitude than the variations of earlier models of beam current integrators. The potential of the collecting electrodes is maintained constant while the summation of the beam current over a given time interval is obtained. (auth)